NNG13451284R

# ATTACHMENT A

# TECHNICAL SPECIFICATIONS

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**Attachment A Technical Specifications**

**List of Abbreviations**

AC Alternating Current
AD Active Directory
AES Advanced Encryption Standard
ANSI American National Standards Institute
API Application Programming Interface
ASN Abstract Syntax Notation
BIOS Basic Input/Output System
BGP Border Gateway Protocol
BMC Baseboard Management Console
BNC Bayonet Neill–Concelman
CCD Charge Coupled Device
CCMP Counter Cipher Mode with Block Chaining Message Authentication Code Protocol or CCMP (CCM mode Protocol)
CIF Common Image Format
CIFS Common Internet file system
COTS Commercial Off-the-Shelf
CPU Central Processing Unit
CRT Cathode Ray Tube
CWDM Coarse Wavelength Division Multi-plexing
DAT Digital Audio Tape
DBMS DataBase Management System (rdbms for Relational)
DPI Dots per Inch
DS3 Digital Signal (level) 3
DVI Digital Visual Interface
DVR Digital Video Recorder
DWDM Dense Wavelength Division Multi-plexing
EAP Extensible Authentication Protocol
EIA Electronic Industries Association
EPEAT Electronic Product Environmental Assessment Tool
EPO Emergency Power Off
FCoE Fibre Channel over Ethernet
FDR Fourteen Data Rate
FIPS Federal Information Processing Standards
FIT Frame Interline Transfer
FT Frame Transfer
GByte Gigabyte
GbE Gigabit Ethernet (GbE or 1 GigE)
GHz – Gigahertz, $10^9$ Hz
GIS Geographic Information System
GPFS General Parallel File System
GPS Global Positioning System
GPU Graphics Processing Unit
GTC Generic Token Card
GUI Graphical User Interface
HDMI High Definition Multi-Media Interface
HDTV High Definition Television
HPGL Hewlett Packard Graphics Language
HSM Hierarchical Storage Management
HTML HyperText Markup Language
HTTP HyperText Transfer Protocol
Hz Hertz (cycles per second)
ICMP Internet Control Message Protocol

IEC International Electrotechnical Commission
IEEE Institute of Electrical and Electronics Engineers
IETF Internet Engineering Task Force
I/O Input/ Output
IP Internet Protocol
IPMI Intelligent Platform Management Interface
IPX Internetwork Packet Exchange
iSCSI Internet Small Computer System Interface
ISO International Standards Organization
ITU International Telecommunications Union
JPEG Joint Photographic Experts Group
KVM (keyboard, video and mouse switch), a hardware device that allows a user to control multiple computers
LAN Local Area Network
LCD Liquid Crystal Display
LDAP Lightweight Directory Access Protocol
LED Light Emitting Diode
LTO Linear Tape Open
MAC Medium Access Control
MByte Megabyte
Mbps Megabits per Second
MIB Management Information Base
MIC Message Integrity Check
MFD Multi-functional device
MFP Multi-functional printer
MMF Multi-Mode Fiber
MOSPF Multicast Open Shortest Path First
msec Milliseconds
MPLS Multi-Protocol Label Switching
NASA National Aeronautics and Space Administration
NEPA National Environmental Policy Act
NFS Network File System
NI Network Interface
NIC Network Interface Card
NIST National Institute of Standards
NTP Network Time Protocol
NTSC National Television Standards Committee
OCR Optical Character Recognition
OEM Original Equipment Manufacturer
OODBMS Object-Oriented Database Management System
OS Operating System
OSI Open System Interconnect
OSPF Open Shortest Path First
Pbyte Petabyte
PC Personal Computer
PCI Peripheral Component Interconnect
PCL Printer Command Language
PDF Portable Document Format
PDU Power Distribution Unit
PEAP Protected Extensible Authentication Protocol
PHY Physical Layer Protocol
PIM Protocol Independent Multi-cast
PIV Personal Identity Verification
PMD Physical Media Device
PNNI Private Network to Network Interface
POP Post Office Protocol

PUE Power Usage Effectiveness
QDR Quad Data Rate
RAID Redundant Array of Independent Disks
RAM Random Access Memory
RDBMS Relational Data Base Management System
RFC Request For Comments
RFP Request For Proposal
RIP Routing Information Protocol
RMON Remote Monitor/Monitoring
RMS Root Mean Squared
RMU Rack Mount Unit
ROM Read-Only Memory
SAC Single Attached Concentrator
SAM-FS Storage Archive Manager File System
SAN Storage Area Network
SAP Service Advertisement Protocol
SAS Single Attached Station
SATA Serial ATA
SCSI Small Computer System Interface
SMP Symmetric Multi-Processing
SNMP Simple Network Management Protocol
SONET Synchronous Optical NETwork
SQL Structured Query Language
SSD Solid State Drive
SSH Secure SHell
TBD To Be Designed/Determined
TByte Terabyte
TCP Transmission Control Protocol
TIFF Tagged Image File Format
TKIP Temporal Key Integrity Protocol
TLS Transport Layer Security
UDP User Datagram Protocol
UPS Uninterruptible Power Supply
USB Universal Serial Bus
VC Virtual Circuit
VGA Video Graphics Array
VHS Video Home System (VCR)
VLAN Virtual Local Area Network
VP View Processor
WAIS Wide Area Information Server
WAN Wide Area Network
WDM Wavelength Division Multi-plexing
WEP Wired Equivalent Privacy
WPA Wi-Fi Protected Access
XNS Xerox Network Systems Protocol

# 1. Introduction

Section 1 provides a general overview of the structure of these technical specifications.

## 1.1. Background

The computer facilities at NASA are being systematically enhanced by incorporating the latest in state-of-the-art computer system technologies. These improvements will enable NASA to remain at the leading edge in scientific and engineering processing performance and capabilities and to provide the user community of researchers and engineers with the most advanced and powerful computer tools available. In support of this activity NASA is establishing Indefinite Delivery/Indefinite Quantity contracts of scientific and engineering computer systems and supporting equipment. The computer systems will provide computational and graphics capability to the scientific engineering and other technical disciplines supporting NASA's core missions. The specifications presented in this document represent a comprehensive set of requirements intended to provide a complete environment for computational analysis by NASA engineers and scientists.

## 1.2. Requirements Structure

The very broad range of NASA's functions in space, earth science, aeronautics, manned flight, mission operations and other activities, results in an equally broad range of computational requirements and consequently a requirement for a broad range of computer systems and support equipment. The requirements are structured in a way that clarifies NASA's needs and categorizes the requirements on the basis of application functions. This structure is defined through two categories: Category A consists of a group of functional computer systems; Category B consists of complementary products and services that enhance and support the computer system functions.
This procurement is for 5 competition areas consisting of one Category A computer system competitions composed of one Group, and 4 Category B supporting equipment competitions composed of 3 Groups. Each of the groups has specific requirements and functional tasks that must be met by the offerings in that group. However, the potential usage of any group is broad and may be based on a variety of applications beyond the specific group definition. The groupings are devised to ensure that the Government has a sufficient set of the best available tools for given tasks. The groupings do not imply either exclusive product offerings by the contractor nor, do they restrict the Government from making best value judgments as to which group to use to meet their specific requirements.

### 1.2.1. Category A Structure

The prelude to the requirements includes the definitions of the computer system group used to identify the general set of applications or environments that distinguish this group. Group definitions are given in Section 2 of this document.

The computer system group is broad and represents a variety of applications beyond the specific group definition, yet this grouping produces enough commonality of requirements that applications in a group can share the same hardware platform.

This group represents not a single specific computer system, but instead represents a family of systems with a range of capabilities. In order to simplify requirements, the group is represented by three types of base systems. These base systems are generally distinguished by performance, upgradability and growth potential and define the minimum range of family of systems that should be provided on the contract. It is anticipated that systems will be made available on the contract through the Available Components list which are compatible with the base systems but which also both fill in and expand upon the requirements fulfilled through the base systems.
In general, application software such as CAD packages, databases, visualization software, etc. must be supported on the computer systems, but need not be provided (i.e. are not mandatory deliverables) unless specifically noted in the mandatory deliverables list in Attachment B. These are referred to as non-mandatory software.
A set of mandatory add-on equipment and upgrades is identified to allow for system enhancements. An available components list consisting of desirable items and other software and hardware which provides depth and breadth to the vendor's offerings, such as computer systems in ranges of sizing and functions that complement the basic systems and non-mandatory software is also included.

### 1.2.2. Category B Structure

The Category B groups consist of a set of capabilities that span across all computer systems via three areas: B) Mass Storage Devices, C) Server Support and Multi-Functional Devices, D) Network Devices, Computer Security Tools and Advanced Video and Conference Tools. Each group has a set of mandatory specifications. In addition, each group includes an available components list consisting of desirable items and other software and hardware that provide depth and breadth to the contract.

## 1.3. Structure of This Document

This section describes the section layouts of the technical specifications.

### 1.3.1. Category A Computer System Group

The specific requirements associated with Group A and derived from the applications to be supported are presented in Section 3.

### 1.3.2. Category B Groups

Requirements for this category are described in separate sections. Category A requirements do not apply to these groups. Mass Storage Devices requirements are described in Section 4. Server Support and Multi-Functional Devices requirements are described in Section 5. Network Devices, Computer Security Tools and Advanced Video and Conference Tools requirements are described in Section 6.

## 1.4. Terminology

Key terms are described in this section.

### 1.4.1. Provide / Support

Two key terms in the technical specifications are: provide and support. Use of the term "provide" indicates a product, service, or capability that is either a mandatory or, if modified by the term "desirable", a desirable deliverable item. All mandatory deliverable products, services and capabilities are identified in the Delivery Lists in Attachment B. A mandatory deliverable is either part of the base system, a separate add-on line item, or a separate upgrade line item. If an item is identified in the technical section as needing to be provided and is not listed in Attachment B as a separate add-on or upgrade line item, it is included as part of the Base system.
Note that the term "provide" implies an item is either a part of every delivered base system or is a separately orderable line item. This distinction is made in the Delivery Lists in Attachment B. For example, a C++ compiler must be provided (as indicated in Section 3.1.4.2.). But the Delivery Lists indicate that the C++ compiler is a separately orderable line item and it is estimated that only a certain percentage of the base systems will be purchased with a C++ compiler over the life of the contract.
Use of the term "support" indicates a product, service, or capability that the systems must be capable of fully utilizing, but which are not part of either the mandatory or desirable deliverable list. When support is used in reference to a software product, a version of the product that can execute on the system must be available in the commercial and/or public domain arena. Supported products, services, or capabilities can be part of the available components list.

### 1.4.2. Deliverables

The delivery lists use abbreviated terminology for clarity in enumerating delivery items. The complete specifications for these delivery items are fully described in Sections 3 through 6. As an example, the delivery list identifies the operating system as a deliverable and the full set of specifications for that operating system is given in Section 3. This includes items such as file system, system administration, shells, etc.
Deliverables are divided into mandatory and non-mandatory categories:

#### 1.4.2.1. Mandatory Deliverables

Each of the separate group specifications produces a separate set of mandatory deliverables for each group. These delivery requirements are specified in Attachment B of this contract. The deliverables are divided into a Base Deliverable, and Add-on / Upgrade Deliverables. The Base Deliverables represent the minimum system configuration to be delivered for each equipment category. Add-on deliverables are mandatory line items that may be added to the Base deliverable at the discretion of the end-user. Upgrade deliverables are mandatory line items that upgrade; the Base deliverables at the discretion of the end-user, e.g. additional disk and/or memory.

#### 1.4.2.2. Non-mandatory Deliverables

Non-mandatory deliverables are items that go beyond the mandatory deliverables. Non-mandatory deliverables are identified through the available components list and include desirable features, additional technology and other software and hardware that provide depth and breadth to the offering.

### 1.4.3. Minimums / Desirables / Advanced Technology / Additional Technology

All technical specifications fit into one of four categories: minimum mandatory; desirable feature; advanced technology, or additional technology.
If a technical specification is not explicitly identified as advanced technology, additional technology or a desirable feature, it identifies a minimum mandatory that must be met. Alternatively, if a technical specification is identified as advanced technology, additional technology or a desirable feature, it is not a minimum mandatory but a technology, item or feature that the Government deems to have value if available.
If a technical section contains the term "desirable", then the section identifies a feature that the Government desires but which the vendor is not required to provide or support.
If a technical section contains the term "advanced technology", then the section identifies advanced capabilities that provide the Government with significant added benefit. These are typically features that are either at the cutting edge of technology or for which standards (industry or de-facto) are still forming.
A technical requirements section may contain the term "additional technology". This designation identifies a basic capability that is intended to provide the Government with added value if the additional technology is provided in the Available Components list. Typically, "additional technology" indicates broad grouping of technology that, if included in the Contractor's offerings, will provide the opportunity for one-stop solution shopping. For example, network technology is an additional technology in the Mass Storage Devices group as network products are an integral feature of many mass storage systems.

### 1.4.4. Authorized Reseller

At the beginning of the mandatory requirements for each Group, a listing is provided of those items for which the offeror must be authorized by the original equipment manufacturer (OEM) to sell as part of their SEWP V proposal. For the purpose of this proposal only, an authorized reseller is defined at a minimum as a company who is known by the OEM and for whom the OEM has approved the proposed mandatory offering(s). For each such identified item, the offeror must provide an OEM point of contact who can verify that information.
If the offeror is the OEM, then that is equivalent to the offeror being an authorized reseller and the POC information should note a POC within that offeror's company.

## 1.5. Assistive Technology

All computer systems available and procured through this Contract must be technically capable of supporting commercially available and appropriate technology to ensure that Federal employees with disabilities will have access to and use of that technology unless a department or agency exception to this requirement exists.

### 1.5.1. Section 508 Information

All IT equipment available through this contract that fit the criteria as electronic and information technology (EIT) as defined in Section 508 of the Rehabilitation Act of 1973 as amended by the Workforce Investment Act of 1999 shall have information available to the Federal Government regarding how that technology meets the applicable Section 508 standards. This will preferably be provided through the applicable Voluntary Product Accessibility Templates (VPATs) as described on the Section 508 website (www.section508.gov and related sites). The VPATs or similar information may either be provided on the contractor's website, on demand based on request for quotes and/or through link on the SEWP Website. Section C.1.8. outlines the compliance and information requirements associated with the Section 508 standards.

All proposed mandatory products must indicate how applicable 508 requirements are met by either providing a VPAT or other supporting documentation.

## 1.6. Environmentally Preferable Purchasing Program

All federal procurement officials are required by Executive Order 13101 and Federal Acquisition Regulation (FAR) to assess and give preference to those products and services that are environmentally preferable. Therefore all institutional purchasers who evaluate and select computer desktops, laptops, and monitors available and procured through this Contract should to the greatest extent possible meet the evolving standards associated with the Environmentally Preferable Purchasing Program (EPP) and the IEEE 1680 Standard for the Environmental Assessment of Personal Computer Products as described on the website (http://www.epeat.net)). The Contractor shall have the ability to respond to specific requests and requirements centered on the EPP such as requests based on the Electronic Product Environment Assessment Tool (EPEAT) and identifying EPEAT registered products on their contract.

## 1.7. Minimum Mandatory Product Condition

All products proposed to meet the minimum mandatory requirements must be new products; i.e. refurbished and/or used technology cannot be proposed in response to a minimum mandatory requirement. Used and refurbished equipment may be proposed as part of the available components as defined in Section C.1.6. Used Equipment and Materials.

## 1.8. Definitions

To clarify meaning of some terms used in this specification, some definitions are given here.

| | |
|---|---|
| 508 (Compliance) | Federal agencies are required to make their electronic and information technology accessible to people with disabilities. Section 508 is an amendment to the Rehabilitation Act. |
| | |
| Add-ons: | Add-ons are mandatory line items which may be added to the Base deliverable at the discretion of the end-user. |
| | |

| | |
|---|---|
| Additional Technology | A basic capability that is intended to provide the Government with added value if the additional technology is provided in the Available Components list. |
| | |
| Advanced Technology | Advanced capabilities that provide the Government with significant added benefit. |
| | |
| Available Bus Slots: | The number of unused bus slots available for expansion after satisfying the requirements of the minimum mandatory deliverables and the maximum disk storage requirements for the base computer system. |
| | |
| Available Components | Non-mandatory deliverables including desirable features, additional technology and other software and hardware that provide depth and breadth to the offering. |
| | |
| Base Systems | The systems which must meet the minimum mandatory specifications and be provided for on the Contract |
| | |
| Category: | A set of technology based on similar objectives and/or overall structure |
| | |
| Computer Room Environment: | Facilities in which special environmental factors are maintained, such as controlled temperature and humidity, where noise is not limited by office requirements, and in which reliable power systems are available and/or are at levels other than the standard 110 volt, 60 Hz. |
| | |
| Computer System: | A computer workstation or server |
| | |
| Core Specifications | Set of technical specifications that are included in all requirements within the specified category or group |
| | |
| Desirable Feature | A feature that the Government desires but which the vendor is not required to provide or support |
| | |
| Energy Star (Compliant) | Energy Star (TM) is an international standard for energy efficient consumer products originated in the United States of America. |
| | |
| FIPS 140 | Federal Information Processing Standards (FIPS) are U.S. government computer security standards that specify requirements for cryptography modules. http://en.wikipedia.org/wiki/FIPS_140 |
| | |
| Group: | A grouping of technological requirements based on common functionality |
| | |
| Group Specific Specifications | Set of technical specifications that are specific to the given Group |
| | |
| Infiniband | **InfiniBand** is a switched fabric communications link used in high-performance computing and enterprise data centers. http://en.wikipedia.org/wiki/Infiniband |
| | |
| Mandatory Deliverables | Products that must be included in the Contract in order to meet the mandatory requirements of the group |
| | |

| | |
|---|---|
| Mandatory Specifications | Set of technical specifications that must be meet by the mandatory offerings |
| | |
| Non-Mandatory Deliverables | Products that go beyond the mandatory deliverables are identified through the available components list and include desirable features, additional technology and other software and hardware that provide depth and breadth to the offering. |
| | |
| Non-Mandatory Desirable Feature: | A capability that is desired by the Government but not required. |
| | |
| Office Environment: | A human work area providing moderate environmental conditioning but with limited capacity to support or provide unusual power or temperature/humidity requirements, and one that may be easily upset by equipment emitting excessive heat and/or noise. |
| | |
| Open Bus Architecture: | A bus with multivendor support. This means that there is an industry published specification to enable third party connectivity. |
| | |
| Open Systems Environment: | The comprehensive set of interfaces, services, and supporting formats, plus user aspects, for interoperability or for portability of applications, data, or people, as specified by information technology standards and profiles. Source: IEEE P1003.0 POSIX Committee. |
| | |
| Provide: | Indicates a product, service, or capability that is either a mandatory or, if modified by the term "desired", a desirable deliverable item. |
| | |
| such as: | The term "such as" is used to list example products that are known to meet the stated capability, and for which products that also meet the stated capability may be substituted. |
| | |
| Support | Indicates a product, service, or capability that the systems must be capable of fully utilizing, but which are not part of either the mandatory or desirable deliverable list. |
| | |
| TAA (compliant) | TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products. This act requires that contractors must certify that each end product meets the applicable requirements. End products are 'those articles, materials and supplies to be acquired for public use'." This includes items which have been "substantially transformed" in the United States. |
| | |
| TWAIN | A standard software protocol and applications programming interface (API) that regulates communication between software applications and imaging devices such as scanners and digital cameras. http://en.wikipedia.org/wiki/TWAIN |
| | |
| Upgrades: | Upgrades are mandatory line items that upgrade the Base deliverables at the discretion of the end-user; e.g. additional disk and/or memory. |
| | |
| Virtual File System | A virtual file system is an abstraction of a physical file system implementation. It provides a consistent interface to multiple file systems, |

| | |
|---|---|
| | both local and remote. This consistent interface allows the user to view the directory tree on the running system as a single entity even when the tree is made up of a number of diverse file system types. The interface also allows the logical file system code in the kernel to operate without regard to the type of file system being accessed |
| | |
| Waterless Fire Suppression | E.g. Dupont FM-200 used as a gaseous fire suppression agent. http://en.wikipedia.org/wiki/Heptafluoropropane |

## 2. Contract Definitions

Section 2 provides general paragraph descriptions of the various SEWP Groups.

## 2.A. Category A: Scalable Computer System Group

This Section provides general paragraph descriptions of the SEWP Group in Category A.
The Computer Systems/Server group of systems and services will be used to provide systems that shall be scalable and applied to meet a wide range of computer and data-intensive requirements. The requirements include compute-intensive traditional optimized applications such as modeling, and mathematical analysis. Applications include, but are not limited to, atmospheric and oceanographic modeling, ocean color or crustal dynamics studies, ozone and sea-ice mapping, radio astronomy, high-energy astrophysics applications, flight dynamics computations, and fluid flow dynamic process modeling. These systems may need Infiniband network interconnects to achieve the very highest performance. These systems may be used in the configuration of highly virtualized arrays of servers, connected together in a super-computer configuration or managed selectively.
These computer systems may also be configured for high performance visual rendering, image analysis and the acceleration of general-purpose scientific and engineering applications. This work is often combined with the highest quality in the visual representation of data to the user.
Typical applications from the Earth and Space science communities are modeling, data assimilation and analysis. Earth and space scientists require the ability to transform volumetric data at high rates to view different perspectives quickly. Additionally, photo realistic representations of data such as the planet Earth with full texture maps are needed to accommodate the overlay of geophysical parameters obtained from spacecraft observations. Three dimensional simulations of the Earth system that generate terabytes of data are performed on high performance systems. Applications from the engineering community include modeling the spacecraft and sensor design. NASA has a critical need to support the real-time modeling of these spacecraft using high speed animation of these vehicles and their antennas (or arms), where the antennas (or arms) move independently of each other. Computer systems must be able to display large numbers of polygons per second to meet the animation needs of the robotics community as well as provide a high degree of graphical representation of the objects displayed.
This Group of computer systems may also be configured to be used to manage large repositories of data ranging up to high-end hierarchical mass storage systems, storing and retrieving hundreds of gigabytes to tens of terabytes of data each day with total archive capacity of Petabytes. Fast networking such as 10-Gigabit Ethernet will be required to access the data from other hosts. Data will be stored initially on high-performing RAIDed disk subsystems and then copied to lower levels in the storage hierarchy. These lower levels must also be high performing and could include solid state disks (SSD) lower-cost disk arrays, massive arrays of idle disks (MAID), tapes or other removable media within robotic libraries. Data is staged back to primary RAIDed disk automatically upon retrieval. Users expect stores and retrieves to be accomplished within seconds. These systems are anticipated to be used in conjunction with mass storage devices as defined in Group B.
Alternatively, these computer systems will be used to house large data volumes and large databases. Applications are typically based on commercial DBMS packages. In addition, these systems would typically provide capability for archival and digital libraries. The critical features of such systems include: high rate of transactions per second, high performance, low latency networks, high volume of network traffic, fast disk access, large amounts of memory (RAM), high volume of memory to disk transfers, and large amounts of secondary storage.
The critical features of this Group are high compute capability, scalability (potentially from a single rack to multiple racks to a series of containers) fast primary storage and network communications, and large data storage capability. 128-bit arithmetic may be needed to support these requirements. This group of system will most likely reside away from the user's work area and be accessed primarily over the network.
This Group will include hardware systems and peripherals, software and software licenses, and hardware and software maintenance services including analyst support.

## 2.B. Category B: Complementary Products Categories

This Section provides general paragraph descriptions of the SEWP Groups in Category B
Category B (Complementary Products)
Group B – Mass Storage Devices

Group C – Server Support and Multi-Functional Device
Group D –Network Devices, Computer Security Tools and Advanced Video and Conference Tools

### 2.B.1. Group B – Mass Storage Devices

This group consists of storage devices; e.g. Hard disks and removable media systems which can be used by any of the computer systems in Category A along with virtual storage systems (i.e. cloud computing). While it is anticipated that products in this group will be purchased for use with any of the Category A systems, this group is particularly concerned with providing mass storage I/O devices for use with the systems managing large RAID storage, large archives, and other "big data" systems.

### 2.B.2. Group C – Server Support and Multi-Functional Device

This group includes Input and Output peripherals and other equipment that support and complement the full implementation of computer systems. These items may be purchased by the Government separately from the computer systems but rely on standards and standard interfaces to ensure interoperability with existing computer systems. Included in this group are display terminals and systems and other low-end client systems to allow user connectivity to a full range of computer systems; scanners to allow inputting of information from hard-copy forms; input devices such as sensors directly connected to computer monitoring systems; mobile systems and smart phones to allow mobile access to individual's computing needs.
This group also includes Multi-functional devices (MFD) which are single devices that serve several functions, including printing, scanning, faxing and photocopying.

### 2.B.3. Group D –Network Devices, Computer Security Tools and Advanced Video and Conference Tool

This group consists of a range of network equipment in support of the full implementation of computer systems in the NASA network environment. These items may be purchased by the Government separately from the computer systems but rely on standards and standard interfaces to ensure interoperability with those systems. Hardware, including hubs, switches, routers, NFS routers, concentrators and diagnostic tools, and software including network management are included in this group. Networking systems also include network communication devices relying on WIFI, radio and related technology.
This group consists of security oriented hardware and software needed to securely support a full implementation of computer systems and infrastructure in the NASA information technology environment. These items may be purchased by the Government separately from the computer, but rely on standards and standard interfaces to ensure interoperability with the computer systems and the supporting networks. Items in this group will include virus and spyware detection tools, two and three factor authentication tools, firewalls, auditing tools, intrusion detection systems, encryption capabilities, monitoring tools, and secure remote access tools. Security hardware products include biometric devices and security related sensors and data input devices.
This group consists of a range of equipment in support of digital television image production and related imaging and display tools. The Government may purchase these items separately from computer systems, but rely on standards and standard interfaces to ensure interoperability with those systems. The hardware in this group includes High Definition (HD) and Standard Definition (SD) Digital TV (DTV) equipment for video acquisition, production, post-production, distribution, and display. Additionally, the increasing complexity and volume of scientific data benefit from paradigms for interaction and visualization that are much closer to normal human interaction in the physical world. These paradigms require immersion and stereoscopic viewing for three-dimensional data, tracked and/or haptic devices with high degrees of freedom, and audio processing systems for data sonification. Where appropriate, these devices may act as input/output peripherals to developmental computer systems.
Elements of the main categories of AV, security and networking can be combined to provide all-in-one solutions. The combination of security and AV technology, for example, allows for security and command and control systems such as video security systems. Networking, communication and AV combine for Videoconferencing solutions.

# 3. Category A: Group A: Computer System Specifications

Section 3 provides the mandatory technical specifications for Group A: Computer System Class Equipment.

## 3.1. Core Specifications Introduction

This section provides a general overview of the core specifications.

All proposed mandatory products must meet the following (where applicable):

a. EPEAT certified
b. Energy Star compliance
c. 508 compliance
d. Trade Act (TAA) compliance
e. New Equipment
f. Authorized reseller for the following mandatory products:

- Mid-range cluster
- High-end cluster
- Container based systems

### 3.1.1. Purpose

The purpose of this section is to define the Core Specification requirements for the mandatory computer systems in Group A

### 3.1.2. Background

The Core Specifications apply to the base and mandatory products for the mandatory computer systems, unless a deviation to the Core Specifications is noted in the Specific Sections.

### 3.1.3. Hardware

This section describes the core hardware specifications. The goal of the core system specifications is to ensure system compatibility from low to high end systems where applicable.

#### 3.1.3.1. Data Storage Components

a. Hard disk storage shall be provided with each system. The storage requirements are class specific.
b. All storage devices shall be field installable.
c. All storage devices shall provide hard error detection (resulting in a non-recoverable failure) and all such errors shall be reported to the system logs.
    1. All storage devices shall provide detection of all errors (recoverable and non-recoverable)

#### 3.1.3.2. Communication / Network Interfaces

a. Native support of Internet Protocols (IP) is required for compatibility with existing network and computing platforms.
b. Each computer system shall provide an IEEE 802.3, ISO 8802/3 1000Base-T Ethernet interface in the base systems.
    1. Options for additional physical Ethernet interfaces (desirable)

### 3.1.4. System Software

This section describes required functions and features that normally are performed by the system software. The operating system software shall support the hardware. The system software shall support a set of development tools and utilities to augment the capabilities of the operating system and the required language processors. These software tools shall provide fast, efficient mechanisms to develop application programs, backup and restore files, debug programs, and supply other useful system functions.

#### 3.1.4.1. Operating System

The operating system (OS) shall be identified in terms of type (e.g. UNIX, Linux, etc), version and any branding certification or other standards covered by the OS

#### 3.1.4.2. Programming Environment

The class 1 and 2 systems shall provide:

a. An ISO compliant C++ compiler (ISO/IEC 14882:2011) which shall include:
   1. run-time libraries.
   2. a C++ source language compatible symbolic debugger with capability to read core dumps. Shall display source code, program variables (including register contents), debugger commands, and debugger output. Display of original names of source code variables.
   3. a single (1) user license
      a. an optional site license (desirable)

b. an ISO compliant Fortran 2008 standard compiler (ISO/IEC 1539-1:2010) which shall include:
   1. run-time libraries.
   2. a Fortran source language compatible symbolic debugger with capability to read core dumps. Shall display source code, program variables (including register contents), debugger commands, and debugger output. Display of original names of source code variables.
   3. a single (1) user license
      a. an optional site license (desirable)

#### 3.1.4.3. System Software License

Each computer system in class 1 and 2 shall be a multiuser system. The operating system license shall be available in at least 1 licensing level for all systems:

a. an unlimited license defined as allowing an unlimited number of users to be logged in simultaneously, where 1 or more may be logged in through the console and the rest are connected through a network connection

### 3.1.5. Documentation

The contractor shall provide access to complete sets of commercially available system and user manuals. All provided documentation shall be available on line.

## 3.2. Group A: Computer System Class Specific Specifications

For each of the three classes in Group A, contractors are required to meet both the core requirements defined in the "Computer System Core Specification" (Section 3.1) and the additional mandatory requirements defined for that class, provided in each of the subsections that follow, unless otherwise noted.

If there is a conflict in requirements between the Class Specific Specification and the Core Specification, the Class Specific Specification shall always take precedence.

Each class is differentiated by performance and capacity and is intended for use by highly intensive computational and related (mass storage, database, rendering, etc.) operations. Each class is intended to be highly scalable and configurable for redundant and fault-tolerant operation.

### 3.2.1. Class 1: Mid-Range Cluster

The purpose of this section is to define the specific requirements for a mid-range Cluster System. The following specifications are required of these Class 1 computer systems over and above, or in place of the core specifications defined in Section 3.1.

#### 3.2.1.1. Hardware Configuration

The Mid-Range cluster architecture requires a total of thirty-six (36) nodes. Management nodes shall be connected to two different internal networks: 1GbE for management and a 10GbE for data. Each data node shall be connected to the 1GbE management network. All Class 1 Mid-Range Cluster systems shall provide the following minimum capabilities, unless noted as a desirable:

a. Operate in a computer room environment with raised floors;

b. Either SATA or Near-Line SAS Disk Controllers shall be provided with each node;

c. SmartPDU:

(1) Sufficient to connect the power supplies of all Nodes, Switches and KVM;

(2) Cables to fully connect all Nodes, Switches and KVM;

d. Provide 2 Management Nodes, where each Node shall be provided with the following configuration:

(1) Dual Socket Motherboards;

i. Oct-Core Intel "SandyBridge" 2.3GHz processors
1. Oct-Core Intel "SandyBridge" 2.5GHz processor (desirable)
ii. 32 GB of RAM

(2) Management Network: Minimum of one (1) GbE on-board Network Interface Card (NIC) with Baseboard Management Console (BMC);
(a) Must be compatible with IPMI Version 2;

(3) Local Area Network: 10GbE NIC with optics and 25-meter fibre cables;
(a) 40GbE NIC with optics and 25-meter fibre cables (desirable);

(4) Data Storage:
(a) minimum of 36Terabytes of storage for data;
(b) hard drives shall be hot-swappable;

(5) Operating System Drives:
(a) Dual operating system hard drives with a minimum of RAID0 and RAID1 support;
(b) 500GB capacity minimum;
(c) Hot-swappable (desirable);

(6) Head Nodes shall have redundant power supplies;

(7) Full cabling shall be provided for all network and power connections;

(8) Rack rails for all nodes shall be provided.

e. Provide 34 Data Nodes, where each node shall be provided with the following configuration:
1. Dual socket motherboards:

i. Oct-Core Intel "SandyBridge" 2.3GHz processors
    1. Oct-Core Intel "SandyBridge" 2.5GHz processor (desirable)
ii. 32 GB of RAM

2. Management Network: Minimum of one (1) GbE on-board Network Interface Card (NIC) with Baseboard Management Console (BMC);
    i. Must be compatible with IPMI Version 2;
3. Data Storage:
    i. minimum of 36Terabytes of storage for data;
    ii. hard drives shall be hot-swappable;
4. Operating System Drives:
    i. Dual operating system hard drives with a minimum of RAID0 and RAID1 support;
    ii. 500GB capacity minimum;
    iii. Hot-swappable (desirable);
5. Data Nodes shall have redundant power supplies;
6. Full cabling shall be provided for all network and power connections;
7. Rack rails for the switch shall be provided.

f. Provide one (1) Management Network GbE Switch with the following configuration:
    1. 48-port GbE switch;
    2. Hot-swap power supplies and fans;
    3. Switch shall be Layer 2 with support for multiple VLAN and bonding;
    4. Switch shall be provided with all cabling and adapters for console access;
    5. Switch shall be provided with redundant power supplies and power cables to allow the switch to be connected to two different PDUs fed from different circuits within the same rack.

g. Provide racks:
    1. Racks shall be provided to support all nodes, KVM and switches and shall be configured with redundant PDUs;
    2. Power tails shall be IEC309.

h. Provide a KVM to support all nodes:
    1. All nodes shall have a dedicated KVM network or connection;
    2. Cables and dongles shall be provided to manage all nodes.

i. The following software shall be supported and the names of a sample software package provided:
    1. Software utility that performs remote BIOS updates and modifications across all nodes from a central location:
        i. The utility shall operate under Linux;
        ii. The utility shall enable management of the following for each node:
            1. Power management settings;
            2. C-state settings;
            3. P-state settings;
            4. CPU and Memory performance;
            5. Hyperthreading;
            6. Turboboost;
            7. Serial port settings for console redirection.
    2. Cluster Management software:
        i. Cluster Management shall perform "node provisioning";
        ii. Cluster Management shall support "versioning" of the software being provisioned to the nodes (Advanced Technology).
    3. Shared File System (Desirable).
    4. Scheduler software (Desirable).

**3.2.1.2. Data archive**

In some instances, this Class will be configured to host large digital archives or as large file servers. To meet this requirement, storage management systems must be supported. All Class 1 systems shall provide a Hierarchical Mass Storage System that shall support the following minimum capabilities, unless noted as a desirable:

a. This class must provide one of the following storage systems with an initial configuration of at least 10 PB of storage:
    1. IBM TS3500;
    2. SpectraLogic T-finity;
    3. Oracle SL8500;
    4. Or equivalent.
b. The storage library must scale to a minimum of 50 Petabytes;
c. One or more of the following media types must be provided to store 10 Petabytes of uncompressed data:
    1. T10K (or better);
    2. LTO-6 (or better);
    3. IBM 3592 (or better);
    4. Or equivalent.
d. Tape drives to support the provided media:
    1. Fifty tape drives;
    2. Tape SAN switches and cabling (e.g. Brocade) to support the 50 tape drives.
e. Disk cache of 5 Petabytes;
    1. Disk SAN switches and cabling (e.g. Brocade) to support the disk cache.
f. The file management storage system must be hierarchical, such as SAM-FS or Data Migration Facility. The hierarchical storage management system should be scalable up to at least 100 Petabytes, providing the user a way to build up to full use of the archive storage system.
g. Dual (or multiple) tape copies of a file; multiple server capabilities (server functions spread over multiple machines) as described in the IEEE Mass Storage Reference Model; support for higher scalability (e.g. storage capacity up to 50 or more Pbytes) and other advanced functions / capabilities for the hierarchical storage management system (advanced technology).
h. The Hierarchical Mass Storage System Software shall have the ability to at least:
    1. locate, mount, read and write storage media;
    2. support Linux/UNIX native file system user calls and commands, e.g. "ls", "touch", etc.;
    3. support access at hard disk storage speed to the most frequently/recently accessed files;
    4. 'vault' media and provide a means of notifying the operator to retrieve a 'vaulted' (i.e. off-line) media when an 'old' file is requested;
    5. employ a 'nameserver' and 'tapeserver' or similar means for locating files on storage media;
    6. provide utilities for backup and recovery of critical files including the Hierarchical Mass Storage System software;
    7. provide a repack function (repack tapes to remove deleted files);
    8. log major activities of software components for system monitoring;
    9. write multiple media (disk, tape, etc.) copies of a file;
    10. scalable up to at least 50 Pbyte, providing the user a way to build up to full use of the mass storage system.
i. Architectural description of a fully configured HSM system, using the required components listed above with 100 Petabyte capacity, writing 150 Terabytes of new data per day, I/O balance of 75% writes and 25% reads, using a Disk SAN (e.g., Brocade) for the disk cache and a Tape SAN (e.g., Brocade) for the Tape drives (Advanced Technology).

**3.2.1.3. Application Software**

In some instances, this Class will be configured to host large databases and/or serve as a render farm, host digital archives, perform as large file servers or serve a combination of these functions. To meet this requirement, the Class 1 computer system shall provide the following software:

a. computer graphic design and rendering software including, but not limited to one user license for:
    1. AutoDesk Maya or equivalent
        (i) Include one year Cloud Subscription;
    2. RenderMan Studio 4 or equivalent.
    3. Pixar RenderMan Pro Server 17 or equivalent
b. database libraries including, but not limited to:

1. Oracle Database 11g R2 Standard Edition or equivalent
   (i) One new user License Per Processor (max 4 sockets) Unlimited use

### 3.2.2. Class 2: High-End Cluster

The purpose of this section is to define the specific requirements for High-End Cluster System. The following specifications are required of these Class 2 computer systems over and above, or in place of the core specifications defined in Section 3.1.

#### 3.2.2.1. Hardware Configuration

This class of system is characterized by system, performance, connectivity, expansion and storage (in-memory and attached) requirements.

The High-End cluster architecture requires two management nodes, two service nodes, sixteen compute nodes with graphical processing units (GPUs) and a total of four hundred and sixty four (464) compute nodes. The two management nodes and two services nodes shall be connected to three different internal networks: 1GbE for management, the 10GbE and the Infiniband network. Each of the 480 compute nodes shall be connected to two different internal networks: 1GbE for management and the Infiniband network for data. All Class 2 High-End Cluster systems shall provide the following minimum capabilities, unless noted as a desirable:

a. Operate in a computer room environment with raised floors;

b. Either SATA or Near-Line SAS Disk Controllers shall be provided with each node;

c. SmartPDU:

   1) Connectivity shall be provided to connect all redundant power connections of all nodes, switches and the KVM;

   2) Cables to connect all nodes, switches and KVM;

d. Provide 2 Management Nodes, where each Node shall be provided with the following configuration:

   1) Dual Socket Motherboards;

   2) Oct-Core Intel "SandyBridge" 2.3GHz processors;

      (a) Next Generation Socket Compatible (Desirable);

      (b) Oct-Core Intel "SandyBridge" 2.5GHz processor (desirable)

   3) 32 GB of RAM;

   4) QDR Infiniband Host Card Adapter (HCA);

      (a) FDR Infiniband (desirable)

   5) Management Network: Minimum of one (1) GbE on-board Network Interface Card (NIC) with Baseboard Management Console (BMC);

      (a) Must be compatible with IPMI Version 2;

   6) Local Area Network: 10GbE NIC with optics and 25-meter fibre cables;

      (a) 40GbE NIC with optics and 25-meter fibre cables (desirable);

   7) Dual 1.0 TB (or greater) capacity 7,200 RPM (or faster) SATA disk drives:

      (a) RAID 0 support;

      (b) RAID 1 support;

      (c) Hot-swappable (desirable);

   8) Management Nodes shall have redundant power supplies;

   9) Full cabling enabling all redundant connectivity shall be provided for all network and power connections;

10) Rack rails for all nodes shall be provided;

e. Provide 2 Service Nodes, where each Node shall be completely redundant and may not be contained within a single chassis or share a planar. Each Service Node shall be provided with the following configuration:

1) Dual Socket Motherboards;

2) Oct-Core Intel "SandyBridge" 2.3GHz processors;

(a) Next Generation Socket Compatible (Desirable);

(b) Oct-Core Intel "SandyBridge" 2.5GHz processor (desirable)

3) 32 GB of RAM;

4) QDR Infiniband Host Card Adapter (HCA);

(a) FDR Infiniband (desirable)

5) Management Network: Minimum of one (1) GbE on-board Network Interface Card (NIC) with Baseboard Management Console (BMC);

(a) Must be compatible with IPMI Version 2;

6) Local Area Network: 10GbE NIC with optics and 25-meter fibre cables;

7) Dual 1.0 TB (or greater) capacity 7,200 RPM (or faster) SATA disk drives:

(a) RAID 0 support;

(b) RAID 1 support;

(c) Hot-swappable (desirable);

8) Nodes shall have redundant power supplies;

9) Full cabling enabling all redundant connectivity shall be provided for all network and all power connections;

10) Rack rails for all nodes shall be provided;

f. Provide 464 Compute Nodes and 16 Compute Nodes with GPUs, where each node shall be provided with the following configuration:

1) All Compute nodes shall be interconnected via Infiniband (QDR);

(a) FDR Infiniband Host Card Adapter (HCA) (desirable);

(b) Infiniband switch topology shall be provided that introduces no more than 16 to 1 blocking between any two nodes

(i) Switch topology that introduces no more than 8 to 1 blocking (desirable);

2) All Compute nodes shall be provided with all necessary cables, rack rails, racks, power supplies, power cables, and cable management;

3) All Compute nodes shall have sufficient cooling for full utilization of the entire cluster at maximum sustained processor performance with either:

(a) Rear door heat exchangers with water connections at the bottom of the door; or

(b) Alternate cooling method that provides sufficient cooling capacity for full utilization of the cluster at maximum processor performance.

4) Dual socket motherboards:

(a) Oct-Core Intel "SandyBridge" 2.3GHz processors;

(i) Next-Generation Socket Compatible (desirable);

(ii) Oct-Core Intel "SandyBridge" 2.5GHz processor (desirable)

(b) 32 Gigabytes of RAM.

5) Option for Many Integrated Core (MIC) (aka Intel Knights Corner):

(a) Option for one MIC per Compute Node;

(b) Two MICs per Compute Node (Desirable):

(i) Full PCI bi-section bandwidth to both MICs (desirable).

6) Management Network:

(a) Minimum of one (1) GbE on-board Network Interface Card (NIC) with Baseboard Management Console (BMC);

i. Must be compatible with IPMI Version 2;

7) Data Storage:

(a) Minimum of 14 Terabytes of storage for data;

i. Minimum of 36 Terabytes of storage for data (desirable)

(b) Hard drives shall be hot-swappable.

8) Operating System Drives:

(a) Dual operating system hard drives with a minimum of RAID0 and RAID1 support;

(b) 7200 RPM (or faster) SATA hard drive;

(c) 500 Gigabytes capacity minimum;

(d) Hot-swappable (desirable).

9) Compute Nodes redundant power supplies (Desirable);

10) Each of the 16 Compute Nodes with GPUs shall be provided with the following configuration:

(a) Sufficient PCI slots and bandwidth to allow for full bandwidth access to all the GPUs attached to the node and the QDR (FDR desirable) Infiniband card. At a minimum, this would require a 1 by 16x PCI-e slot for each GPU and a 1 by 8x PCI-e slot for the QDR (FDR) Infiniband card.

(b) NVidia Tesla K10 or later equivalent version

(c) The GPUs may be housed internal to the node or external to the node as long as the requirement for full bandwidth access between the GPU and the socket is met.

g. Provide a Management Network GbE Switch with the following configuration:

1) Switches shall be provided with sufficient capacity to connect all management, service, and compute nodes, KVM and a minimum of 2 uplinks;
2) Hot-swap power supplies and fans;
3) Switches shall be Layer 2 with support for multiple VLAN and bonding;
4) Switches shall be provided with all cabling and adapters for console access;
5) Switches shall be provided with redundant power supplies and power cables to allow the switch to be connected to two different PDUs fed from different circuits within the same rack.

h. Provide a Local Area Network 10 GbE Switch with the following configuration:

1) Switch shall be provided with sufficient capacity to connect all Management and Service nodes and a minimum of 2 uplinks;
2) Hot-swap power supplies and fans;
3) Switch shall be Layer 2 with support for multiple VLAN and bonding;
4) Switch shall be provided with all cabling and adapters for console access;
5) Switch shall be provided with redundant power supplies and power cables to allow the switch to be connected to two different PDUs fed from different circuits within the same rack.

i. Provide Infiniband Network QDR Switch with the following configuration:

1) Switch(es) shall be provided with sufficient capacity to connect all management, service, and compute nodes and an appropriate number of uplinks in accordance with the blocking factor;
2) Switch(es) shall be fully populated with leaf modules (as necessary);
3) Switch(es) shall have redundant management cards (as necessary);
4) Switch(es) shall have hot-swap power supplies and fans;
5) All IB switch(es) must have redundant power supplies and power cords to allow them to be connected to two different PDUs fed from different circuits within the same rack or nearby racks;
6) Switch(es) shall be provided with all cabling and adapters for console access;
7) FDR Infiniband Switch (desirable);

j. Racks:

1) Racks shall be provided to contain and support all Management, Service and Compute nodes, switches and KVM and shall be configured with redundant PDUs;

2) Power tails shall be IEC309.

k. Cable management for all nodes, switches and KVM:

1) All cables for all nodes, switches and KVM must run either within the rack housing the node or overhead;

2) Overhead cable trays must support and protect the cables;

3) All uplink cables run between the Compute nodes and either the Management network switch or the Infiniband network switch may be run overhead in the cable tray or under raised floor.

l. Provide a KVM capability to support all 484 Management/Service/Compute nodes:

1) Ethernet based (desirable);

2) All nodes shall have a dedicated KVM network or connection;

3) Cables and dongles shall be provided to manage all nodes.

m. Architectural description of a fully configured system, using the required components listed above configured for optimal performance showing both management and IB network topologies and uplinks and including a complete mechanical and electrical description with diagrams (Advanced Technology)

n. The following software shall be supported and the names of a sample software package provided :

1) Software utility performs remote BIOS updates and modifications across all nodes from a central location;

2) The utility shall operate under Linux;

3) The utility shall enable management of the following for each node:

(a) Power management settings;

(b) C-state settings;

(c) P-state settings;

(d) CPU and Memory performance;

(e) Hyperthreading;

(f) Turboboost;

(g) Serial port settings for console redirection.

o. Cluster Management software:
1) Cluster Management shall perform "node provisioning";
2) Cluster Management shall support "versioning" of the software being provisioned to the nodes (Advanced Technology).

p. Shared File System (Desirable).

q. Scheduler software (Desirable).

### 3.2.3. Class 3: Container-based Servers

The purpose of this section is to define the specific requirements for the Container-Based Servers. The requirements stated in this section shall be proposed as a completely integrated solution that would be delivered in a container. The following hardware and software specifications are required of these Class 3 computer systems over and above, or in place of the core specifications defined in Section 3.1.

#### 3.2.3.1. Hardware Configurations

This section describes the container system hardware configurations required for Class 3. Two basic configurations are required: a 3/a container and a 3/b container. For this base system, the configuration is for 3 phase power, an input voltage of 220 V and the environment should be considered ideal; i.e. there are no extreme environmental conditions to be considered.

All Class 3 containers (Class 3/a and 3/b) shall provide the following minimum capabilities, unless noted as desirable:

a. Adiabatic/Ambient cooling (i.e., chiller-free);
b. 25kW/rack power consumption (desirable);
c. Uninterruptible Power Supply (UPS) capacity shall be sufficient to handle transient (10 seconds or less) power fluctuations and short-term interruptions without disruptions to the equipment in the container;
d. UPS capacity shall support orderly shutdown of IT equipment and cooling in case of complete (long-term) power disruption;
e. Highly energy efficient solution with a PUE of 1.3 or better;
    a. PUE of 1.1 (desirable);
f. Emergency Power Off (EPO);
g. Redundant PDUs;
h. Cooling shall provide "N+1" redundancy with no single points of failure;
i. Security shall provide support for electronic entry with logging;
j. Fire suppression:
    a. Comply with NFPA 2001;
    b. Provide manual activation at each egress door;
        i. Provide abort switches at each egress door (desirable)
k. Air Aspirating Smoke Detection System:
    a. Provide a minimum of four alarm levels with the first three alarm levels providing advance warning of a fire condition;
    b. Provide automatic shutdown of all equipment upon a configurable alarm level (e.g., automatic shutdown activated by a level 2 to level 3 alarm transition);
    c. Activation of the fire suppression system upon a level 4 alarm;
    d. Contain dry contacts to interface with external fire alarm network.
l. Manual "pull station" by each door with weatherproof fire alarm horn and strobe light on the container exterior;
m. Monitoring shall be provided for all container alarms, power, temperature, and humidity and shall be accessible remotely and support alerting/paging functions such as via a Nagios server;
n. Built-in facility and environmental monitoring and controls with automated programmable transition to safe-mode in case of unexpected anomalies;
o. Remote management capabilities (desirable);
p. Converged networks (desirable);
q. Single point utility connection;
r. Internal lighting shall provide normal and emergency lighting with exit lighting above all egress doors;
    a. In-floor path lighting (desirable);
s. Internal emergency alarms shall provide both sound and light notifications;
t. External lighting with photocell activation above each exterior door (desirable);
u. Exterior painted with rust-inhibiting epoxy paint.

*3.2.3.1.1. Class 3/a Container-based Computer Systems*

The Class 3/a container shall provide the following minimum capabilities, unless noted as desirable:

a. Capacity for 20 42U racks (double density);
b. 10Gbps Ethernet;
c. 40Gbps Ethernet (desirable);
d. 100Gbps Ethernet (advanced technology);
e. Compute Requirements:
    1. Intel-based, 64-bit architecture, 2.0+ GHz, 2 to 4 processors, 6 to 10 cores per processor;
    2. 128 GB physical memory
        i. Upgradable to 256 GB;
    3. 500 GB internal storage;
        i. Upgradable to 1 TB
    4. Dual or Quad Ethernet;
    5. QDR Infiniband (for internal interconnect backbone);
    6. 32 nodes
f. Storage Requirements:
    1. Dual Controllers for High Availability;
    2. 1.8 PB raw storage capacity
        i. Upgradable to 3.6 PB raw storage capacity;
    3. Provide SAS, SATA or SSD drives;
    4. Support iSCSI, FCoE, NFS, CIFS.

*3.2.3.1.2. Class 3/b Container-based Computer Systems*

The Class 3/b container shall provide the following minimum capabilities, unless noted as desirable:

a. Capacity for 10 42U racks;
b. 10Gbps Ethernet;
c. Compute Requirements:
    1. Intel-based, 64-bit architecture, 2.0+ GHz, 2 to 4 processors, 6 to 10 cores per processor;
    2. 64 GB physical memory;
        i. Upgradable to 128GB
    3. 250 GB internal storage;
        i. Upgradable to 500 GB
    4. Dual or Quad Ethernet;
    5. QDR Infiniband (for internal interconnect backbone);
    6. 16 nodes
d. Storage Requirements:
    1. Dual Controllers for High Availability;
    2. 0.9 PB storage capacity
        i. Upgradable to 1.8 PB;
    3. Provide SAS, SATA or SSD drives;
    4. Support iSCSI, FCoE, NFS, CIFS.

## 3.3. Product Based Services Support

To assist in product recommendations, installation, and support of computer systems products the following specialists shall be supported:

a. Operations Systems Security Specialist
    1. Provides technical knowledge and analysis of information assurance, to include applications; operating systems; Internet and Intranet; physical security; networks; risk assessment; critical infrastructure continuity and contingency planning; emergency preparedness; security awareness and training. Provides analysis of existing system's vulnerability to possible intrusions, resource manipulation, resource denial and destruction of resources. Provides technical support and

analysis to document organizational information protection framework, and supports policy and procedures preparation and implementation.

2. Experience Requirements: Seven years of substantial experience in systems operations.

b. Computer Systems Engineer
   1. Tests and analyzes all elements of the computer systems facilities including power, software, mass storage devices, communications devices, computer systems and terminals and for the overall integration of the enterprise network. Responsible for the planning, design, installation, maintenance, management and coordination of the storage systems. Monitors and controls the performance and status of the storage resources. Utilizes software and hardware tools, identifies and diagnoses complex problems and factors affecting storage performance. Maintains technical currency and studies vendor products to determine those which best meet client needs. Provides guidance and direction for less experienced storage support technicians.
   2. Experience Requirements: Seven years of increasingly complex and progressive experience in computer system/network engineering. Includes two years of specialized experience related to the task.

c. Applications Systems Analyst/Programmer
   1. Formulates and defines system scope and objectives. Prepares detailed specifications for programs. Designs, codes, tests, debugs and documents programs. Works at the highest technical level of all phases of applications, systems analysis and programming activities. Provides guidance and training to less experienced analysts/programmers.
   2. Experience Requirements: Seven years of increasingly complex and progressive experience in performing systems analysis, development, and implementation of business, mathematical, or scientific setting using a variety of information technology resources. Has experience with current technologies and, where required for the task, emerging technologies.

## 4. Category B: Group B: Computer System Storage Devices

This section describes the technical requirements for Storage Devices which complement and support the Computer Systems in Category A.

All proposed mandatory products must meet the following (where applicable):

a. EPEAT certified
b. Energy Star compliant
c. 508 compliant
d. Trade Act (TAA) compliant.
e. New Equipment
f. Authorized reseller for the following mandatory products:

- LTO Desktop Library tape system
- Large Robotic Device
- Server UPS

### 4.1. Single Storage Devices

The following devices must be provided:

a. Blu-ray Disc Player
   1. Built-in WiFi
   2. Built-in 3d
   3. HDMI
   4. 1080i Output
   5. Remote
   6. External hard disk drive - 40GB storage
   7. Game Console (desirable)
   8. Streaming services including annual subscriptions (desirable)

b. Digital Video Recorder (DVR)
   1. Video inputs (IP): 4 video H.264/MPEG4/JPEG data streams
   2. 2 USB ports
   3. Compression (analog): H.264
   4. Support at least 1 internal SATA HDD
   5. Video format (Analog): NTSC: 352x240 (CIF), 704x240 (Half-D1), 704x480 (D1)
   6. Networking: 10/100 Base-T Ethernet, RJ-45

c. the following single tape devices:
   1. DAT 72;
      a. External Drive
      b. 36GB capacity (native)
      c. Data transfer rate 3 MB/sec native
   2. STK T9840D
      a. 75GB capacity (native)
      b. Data transfer rate 30 MB/sec native
      c. Drive level encryption (desirable)
   3. STK T10000C
      a. Read compatible with STK 10000B and 10000A
      b. 5TB capacity (native)
      c. Data transfer rate 240 MB/sec (uncompressed)
      d. Drive level encryption (desirable)
   4. LTO Ultrium;
      a. External Drive (desirable)
      b. 1.5 TB capacity (native)
      c. Data transfer rate 140 MBps native with Ultrium 5 media
      d. Data transfer rate 160 MBps native with Ultrium 6 media
      e. Drive level encryption (desirable)

## 4.2. Multiple Storage Devices

This section describes several mandatory storage devices including a core specification that must be met by all proposed mandatory devices in this section

### 4.2.1. Storage Devices Core Specification

Proposed storage devices shall provide:

a. be attachable to USB, Ultra-SCSI, Fibre Channel, SATA, eSATA, PCI Express, FireWire, InfiniBand, or Thunderbolt
b. devices which are upgradeable and flexible in hardware configuration; e.g. standard housings/sleds which can accommodate different drive capacities/types, (advanced technology)
c. shall be field installable including all necessary cabling and documentation for installation.
d. shall provide error detection.
e. shall provide FIPS 140-2 encryption (desirable)

Proposed storage devices shall support:

f. IBM GPFS file system (desirable)
g. at least one of the following UNIX/Linux/Apple OS X computer system platforms: SGI, IBM, HP, Apple, Linux Kernel 2.4.
    1. attachable to other OS's such as Windows 7/8 (desirable)
    2. compatible with VMware ESX (desirable)
h. Support for:
    1. hardware performance enhancements such as controller caching and in-line compression, (advanced technology)

### 4.2.2. Multiple Storage Device Requirements

a. desktop library systems/Autoloaders which handle the following media and capacity and include all drives and controllers to support the stated capacity:
    1. LTO Ultrium
        a. 40 tape slots
        b. Tape drive
        c. 60 TB capacity (native)
        d. Data transfer rate 140 MBps native with Ultrium 5 media
        e. Library managed encryption (desirable)
b. Enterprise library systems which handle the following media and capacity. The proposed products must include the tape drives, controllers, etc that meet the required capacity:
    1. LTO Ultrium
        a. 200 tape slots
        b. 8 drive bays including drives
        c. 300 TB capacity for Ultrium 5 media(native)
        d. 500 TB capacity for Ultrium 6 media (native)
        e. Aggregate data transfer rate 4.0 TB/hr (native) with 8 Ultrium 5 drives
c. Large robotic device which handle the following media and capacity (uncompressed values). Note: "expandable to" means that a single computer server platform has direct access to the storage device(s) providing the required amount of storage. The expansion can be done through single or multiple enclosures with connections as defined in Section 4.2.1. and must only be supported:
    1. basic configuration of at least 2 PB (native) and 64 drives
    2. expandable to 500 PB (native)
    3. Audit time of under 40 minutes
    4. Average cell to drive time of less than 11 sec
    5. Expandable to 640 drives
    6. Non-disruptive serviceability
    7. Configurable to support STK T9840D/C, STK T10000C/B/A, LTO Ultrium 6/5 drives

d. at least 2 RAID devices:
    1. Blade array (RAID level 0, 1, 5 and 6):
        a. at least 7 TB (native),
        b. Up to 320 MB/s read and 190 MB/s write (RAID 5)
        c. Continual event monitoring
        d. Major components must be hot-swappable
    2. Scalable RAID (RAID level 5):
        a. at least 6 TB (usable),
        b. expandable to 30 TB (usable)
        c. able to include up to 12 FC interfaces
        d. transfer rate of 200 MB/sec per FC interface
        e. Other RAID levels (desirable)

## 4.3. Storage Devices Software

The following Storage related software must be provided:

a. Hierarchical Mass Storage Software:
    1. A commercially available software product that provides:
        a. Initial license for up to 1 PB of data
        b. locate, mount, read and write tapes or disks in the jukeboxes.
        c. support UNIX native file system user calls and commands, e.g. "ls", "touch", etc.
        d. support access at hard disk storage speed to the most frequently/recently accessed files.
        e. 'vault' media and provide a means of notifying the operator to retrieve a 'vaulted' media when an 'old' file is requested.
        f. employ a 'nameserver' and 'tapeserver' or similar means for locating files on media.
        g. provide utilities for backup and recovery of critical databases
        h. repack function (repack tapes to remove deleted files)
        i. log major activities of software components for system monitoring.
        j. write multiple tape copies of a file
        k. scale up to at least 500 Pbyte, providing the user a way to build up to full use of the mass storage system
        l. allow for multiple hierarchies based on various file attributes
b. Other software to assist in the storage and retrieval of data (desirable)
c. Other software in support of RAID and DASD technology (advanced technology)

## 4.4. Virtual Storage Technology

Enterprise-level cloud data storage.

a. Cloud storage services accessible through a web service application programming interface (API), cloud storage gateway or web-based user interface.
b. 10 TB storage
    1. Actual cost based on monthly storage usage
c. Include options for both off-premise and on-premise solutions, or a mixture of the two options (desirable)
d. Highly fault tolerant through redundancy and distribution of data (desirable)
e. Allows creation of versioned copies of files (desirable)
f. Encryption of data during transfer: FIPS 140-2 compliant
g. Encryption of data at rest with encryption keys kept by service user and escrow key available
h. Sharable folders for groups of users (desirable)
i. Integration with active directory (desirable)

## 4.5. Uninterruptible Power Supply

Two Uninterruptible Power Supply (UPS) units must be provided for small office environment and small computer server room server environments

#### 4.5.1. Small Office Environment

The Small Office Environment Uninterruptible Power Supply (UPS) units must provide:

a. Output power capacity of up to 1000 VA and 600 Watts
b. Nominal output voltage of 110/120 VAC and 220/230/240 VAC (user selectable)
c. On line voltage range of +20% for nominal voltage at full load
d. Frequency of 50/60 Hz auto-sensing
e. Runtime at 600 W of 5 minutes
f. Recharge time of 3 hours (to 90% after full discharge)
g. Startup with UPS batteries

#### 4.5.2. Small Server Room Environment

The Small Server Room Environment Uninterruptible Power Supply (UPS) units must provide:

a. Output power capacity of up to 4500 VA and 3500 Watts
b. Nominal output voltage of 120 VAC and 208-240VAC
c. Frequency of 50/60 Hz auto-sensing
d. Runtime at 1400 W of 30 minutes
e. Recharge time of 3 hours (to 90% after full discharge)
f. Startup with UPS batteries
g. Hot-swappable batteries

## 4.6. Data Destruction Services

As part of cradle to grave options, the following data destruction services must be provided and priced per drive / tape:

a. certified e-waste recycler
b. on-site hard drive shredding
c. on-site tape degaussing

## 4.7. Additional Storage Technology

Basic network equipment in support of SAN and other network storage configurations (additional technology)

Devices running client-oriented OSs to allow direct monitoring of storage configurations (additional technology)

Supporting technology such as printers, audio/visual IT equipment, etc. in support of storage configurations (additional technology)

Systems/storage security technology (additional technology)

Image and display tools in support of storage configurations (additional technology)

## 4.8. Storage Specialists

To assist in product recommendations, installation, and support of computer systems products the following specialists shall be supported:

a. Information Assurance Storage Specialist
    1. Analyzes general information assurance-related technical problems and provides basic engineering and technical support in solving these problems. Supports the integration of information assurance solutions and technologies into storage equipment and any connected networks with particular attention to protocols, interfaces, and system design. Analyzes and defines security

requirements for storage area networks. Designs, develops, engineers, and implements solutions that meet network and storage security requirements. Responsible for integration and implementation of the storage security solution. Performs vulnerability/risk analyses of computer systems and applications during all phases of the system development life cycle. Configures test beds and conducts testing, records and analyzes results, and provides recommendations for improvements for the products/systems under test. Analyzes and defines security requirement for computer systems which may include mainframes, workstations, and personal computers. Designs, develops, engineers, and implements solutions that meet security requirements. Responsible for integration and implementation of the computer system security solution. Gathers and organizes technical information about an organization's mission goals and needs, existing security products, and ongoing programs in computer security. Performs risk analyses of computer systems and applications during all phases of the system development life cycle. Applies principles, methods, and knowledge of security to specific areas task order requirements. Test developed systems at each point of entry for ease of unregulated entry; systems resources denial; system information corruption; unlawful use of system resources; vulnerability to electronic disruption.

2. Experience Requirements: This position requires a minimum of seven years of substantial experience in system security analysis and implementation; design assurance or testing for information assurance products and systems; integration or testing for information assurance products and systems. Experience in heterogeneous computer networking technology and work in protocol and/or interface standards specification is recommended.

b. Storage/Hardware Engineer

1. Tests and analyzes all elements of the storage facilities including power, software, mass storage devices, communications devices, computer systems and terminals and for the overall integration of the enterprise network. Responsible for the planning, design, installation, maintenance, management and coordination of the storage systems. Monitors and controls the performance and status of the storage resources. Utilizes software and hardware tools, identifies and diagnoses complex problems and factors affecting storage performance. Maintains technical currency and studies vendor products to determine those which best meet client needs. Provides guidance and direction for less experienced storage support technicians.
2. Experience Requirements: Seven years of increasingly complex and progressive experience in computer system/network engineering. Includes two years of specialized experience related to the task.

## 5. Category B: Group C: Server Support and Multi-Functional Devices

This section specifies equipment needed to support a full implementation of computer systems in the NASA network environment. These items may be purchased by the Government separately from the computer systems but rely on standards and standard interfaces to ensure interoperability with the computer systems.

All proposed mandatory products must meet the following (where applicable):

a. EPEAT certified
b. Energy Star compliant
c. 508 compliant
d. Trade Act (TAA) compliant.
e. New Equipment
f. Authorized reseller for the following mandatory products:

- Tablet
- High speed scanner
- Hi Volume Mono MFP
- Medium Volume Color MFP

## 5.1. Display Devices

Computer display devices are computer peripheral devices capable of showing still or moving images generated by a computer. These devices include but are not limited to desktop LCD monitors, wall-mounted displays, and projector systems onto passive screens and interactive whiteboards.

### 5.1.1. LCD Display Monitor

A desktop 21 inch LCD monitor shall be provided and must include the following minimum capabilities:

a. Color device supporting 16 million colors
b. 21 inch viewable screen (diagonal)
c. Flat-panel display
d. Anti-glare panel
e. Native resolution at least 1920x1080
f. Typical brightness of 250 $cd/m^2$
g. Image contrast ratio of 450:1
h. RGB video input signal
i. Intel PC and Apple Macintosh compatibility

### 5.1.2. Portable LCD Projector

A portable LCD projector shall be provided and must include the following minimum capabilities:

a. 1280x800 native resolution
b. 1600x1200 maximum resolution
c. Brightness of 2000 lumens (ANSI)
d. Speakers
e. PC and Macintosh compatible
f. Maximum throw distance of 29 feet
g. Aspect Ratio of 16:10 (WXGA)

### 5.1.3. Manual screen

A manual wall screen shall be provided with the following specifications:

a. 50inches X 50inches screen size
b. Matte white fabric
c. Wall and ceiling mountable

### 5.1.4. Interactive Whiteboard

An Interactive Whiteboard (a dry-erase whiteboard writing surface which can capture writing electronically and allows interaction with a projected computer image) shall be provided with the following minimum requirements:
The touch-sensitive display connects to your computer and digital projector to show your computer image. You can then control computer applications directly from the display, write notes in digital ink and save your work to share later.

a. 77 inch diagonal active screen area
b. Touch resolution of 4000X4000
c. 4 color (black, blue, red and green) pens
    1. automatic detection of pen in use
d. eraser
e. Software to support:
    1. computer display
    2. note taking
    3. capture and save of all notes / images
f. MS Windows and Macintosh compatible
g. Mobile floor stand (desirable)

## 5.2. Printers

Three printers shall be offered. Capabilities shall be as specified in the following sections. Each printer shall meet the Core Printer Specification and the unique requirements in the printer specific section.

### 5.2.1. Core Printer Requirement

Each of the 3 printers shall provide the following capabilities:

a. Adobe Postscript Level 3.0 formatted print files.
b. Metric A4-size paper with a usable image area of at least 200mm x 271mm and a usable image area of at least 8" x 10" for American Letter-size (8.5" x 11").
c. two interfaces: USB 2.0, and 10/100Base-TX Ethernet
    1. simultaneous availability of the two interfaces; e.g. automatic port sensing/switching
d. Simple Network Management Protocol (SNMP) agent [RFC 1157; RFC 1213] for remote monitoring.
e. PCL5 and PCL6 support
f. Duplex by default

#### 5.2.1.1. Monochrome Laser Printer

In addition to the Core Printer Specification, the Monochrome Laser Printer shall also provide:

a. print speed shall be at least 35 pages per minute.
b. resolution of at least 1200x1200 dpi.
c. minimum memory of 32 MBytes,
    1. memory shall be expandable to at least 256 MBytes.
d. a duty cycle of at least 75,000 pages per month.
    1. duty cycle of at least 100,000 pages per month (desirable)
e. at least 130 fonts.
f. support paper sizes from 3"x5" to 8.5"x14" (legal)
g. Standard input capacity of 850 sheets
h. Standard output capacity of 250 sheets
i. Image processing of 400Mhz
j. Automatic duplex printing
k. Clearing/overwriting an image after completion of each job (Compliance with NIST SP800-88 and NIST SP 800-36)

#### 5.2.1.2. High Speed Monochrome Laser Printer

In addition to the Core Printer Specification, the High Speed Monochrome Laser Printer shall also provide:

a. print speed shall be at least 45 pages per minute.
b. resolution of at least 1200x1200 dpi.
c. minimum memory of 500 MB
    1. memory shall be expandable.
d. a duty cycle of at least 200,000 pages per month.
e. at least 130 fonts.
f. support paper sizes from 3"x5" to 8.5"x14" (legal).
g. Standard input capacity of 1000 sheets
h. Standard output capacity of 250 sheets
i. Image processing of 500Mhz
j. optional "B" size (11" x 17") paper (desirable)
k. UNIX and LINUX OS support (desirable)
l. Enabled card reader for PIV-compliant Smartcards (meets NIST SP 800-96) (desirable)

#### 5.2.1.3. Color Printer

In addition to the Core Printer Specification, the Color Printer shall also provide:

a. print speed shall be at least 30 pages per minute (color)
b. color resolution of at least 600x600 dpi.
c. minimum memory of 1GB,
    1. memory shall be expandable.
d. a duty cycle of at least 150,000 pages per month.
e. at least 130 fonts.
f. support paper sizes from 3"x5" to 8.5"x14" (legal)
g. Standard input capacity of 1000 sheets
h. Standard output capacity of 400 sheets
i. optional "B" size (11" x 17") paper (desirable)
j. UNIX and LINUX OS support (desirable)
k. enabled card reader for PIV-compliant Smartcards (meet NIST SP 800-96) (desirable)

## 5.3. Plotters

One large-format color plotter shall be offered.

### 5.3.1. Color Large-Format Plotter

The Color Large-Format Plotter shall provide:

a. 42 inch wide paper
    1. Media rolls up to 300 ft.
    2. manual sheet feed supporting sizes starting from B/A3-size
    3. standard bin holding at least up to 50 E/A0-size prints.
b. HP-GL/2, HP-RTL and Adobe Postscript Level 3 language support
c. Fast Ethernet (10/100Mbps) connectivity
d. 2400x1200 optimized dpi color
    1. 1200x1200 dpi color on glossy media
e. minimum memory of 256MB (main) and 96MB(imaging)
    1. main memory expandable to 512 MBytes.
f. Maximum print length of at least 295 ft.
g. Hard disk drive of at least 40 GB
h. in fast quality mode, the printer should have the ability to run at least 100 D/A1-size prints per hour
i. Automatic cutter
j. Handle the following media types: plain, inkjet, heavyweight coated, super heavyweight coated, semi-gloss, glossy, translucent bond and photo
k. operation in a Windows or Macintosh environment

## 5.4. Scanners

Two scanners shall be offered. Capabilities shall be as specified in the following sections.

### 5.4.1. High Speed/High Performance Scanner

The High Speed/High Performance Scanner shall provide:

a. High speed SCSI (e.g. Ultra-SCSI, SCSI III, etc.)and USB 2.0 connectivity
b. scanner speed of 57 pages per minute simplex at 200 dpi resolution for 8.5x11 inch monochrome document in portrait mode
c. at least 600 dpi resolution (color and monochrome)
d. Automatic document feeder
    - 150 page capacity
e. duplex (two sided) scanning
f. monochrome and color mode
    1. 24 bit color
    2. 256 level grey scale
g. document size up to at least 11X17 inches
h. OCR software driver

### 5.4.2. Large Format Scanner

The Large Format Scanner shall provide:

a. handle up to 42" wide originals
b. up to 1200 dpi resolution (enhanced)
c. ability to scan up to 2mm thick originals
    1. 12mm thick originals (desirable)
d. 24 bit color scan mode
    1. 48 bit color scan mode (desirable)
e. Color scan speed at 400 dpi of 3 inches per sec
f. Automated color calibration
g. USB 2.0 connectivity
    1. FireWire (IEEE-1394a) connectivity (desirable)

## 5.5. Tablet Computing

A tablet computer, or simply tablet, is a one-piece mobile computer, primarily operated by touch screen (the user's finger essentially functions as the mouse and cursor, removing the need for the physical (i.e., mouse and keyboard) hardware components necessary for a desktop or laptop computer; and, an onscreen, hideable virtual keyboard is integrated into the display).

### 5.5.1. Small format Tablet

a. Color device supporting 16 million colors
b. Optional keyboard
c. 7 inch or less viewable screen
d. Flat-panel display
e. Anti-glare panel
f. Native resolution at least 1024X600
g. Wireless
    1. 802.11n
    2. Bluetooth
    3. 4G (desirable)

## 5.6. Computer Peripherals

Peripheral computer component providers are expected to provide fully "Plug & Play solutions". All hardware, connector cables, power cords, software, and enablement cards to make the system fully functional are to be provided.

### 5.6.1. Ergonomic Mouse

Ergonomic mouse device will include:

a. Elevated hand support for maximum stress reduction
b. Detachable wrist rest (desirable)
c. Options for left or right hand users (desirable)
d. Windows
    a. Macintosh option (desirable)
e. Up to 1000 dpi cursor control
f. USB compatible
g. cordless

### 5.6.2. Ergonomic Keyboards

Fully functional keyboard with focus to align the wrist of the user in a comfortable position. Split keyboards, and standard configurations applicable.

a. Contoured split key design
b. Integrated trackball and mouse buttons (alternate integrated tracking devices such as touchpad or joystick are acceptable) (desirable)
c. Built-in wrist support
d. Dual ALT, SHIFT and CONTROL keys
e. Windows
    1. Macintosh option (desirable)
f. Wireless infrared or Bluetooth (desirable)

### 5.6.3. Data Input Devices

This section provides a mandatory product falling within the general category of sensors and detectors that provide data input into a computer system, tablet, and/or handheld ITC (information technology/communication) device. A complete motion detector solution including sensor and IP communication module must be provided that includes:

a. IP communication module
    1. Send alarm messages and system data to the monitoring center through LAN/WAN network.
    2. Use encryption technology for communication
b. Indoor Infrared Motion detector
    1. Low noise, high sensitivity, dual element, rectangular beam
    2. Fire resistant case

## 5.7. Office Video Conferencing

Office video conferencing to include:

a. Inclusive video conferencing system
b. 20 inch LCD Monitor minimum
c. Camera
    1. 50 degree horizontal field of view
d. Microphone
e. All necessary cabling
f. Speakers
g. IP connection with calls up to 2 Mbps
    1. Option for ISDN connection (desirable)

h. CD quality sound
i. Embedded encryption using Advanced Encryption Standard software
j. SNMP support

## 5.8. Point of Sale All in One System

Point of Sale (POS) to include:

a. Splashproof All-in-one: Touchscreen / CPU / Card Reader
b. Omnidirectional Barcode Scanner
c. Thermal Receipt Printer
d. Cash Drawer
e. Pole Display
f. POS Software (desirable)

## 5.9. Multi-functional Devices

This section specifies equipment commonly referred to as multi-functional printers (MFP) or multi-functional devices (MFD) which are single devices that serve several functions, including printing, scanning, faxing and photocopying. This class provides for both purchases of the devices, either singly or in bulk, as well as a servicing structure wherein the devices remain the property of the Contractor with Government payment for the usage, servicing and provisioning of those devices.

The mandatory requirements in this class can be categorized as the following:

- Purchased High volume monochrome MFD with warranty; consumables purchased separately
- Contractor supplied and maintained High volume monochrome MFD with warranty and consumables included (desirable)
- Purchased Medium volume color MFD with warranty; consumables purchased separately
- Contractor supplied and maintained Medium volume color MFD with warranty and consumables included (desirable)
- Consumables such as paper, toner, staplers, etc.

## 5.9.1. High Volume Monochrome MFD Requirements

The high volume MFD device must meet the following requirements:

a. Fully Automatic Duplexing (1-2, 2-2, and 2-1)
b. Auto Document Feeder (capable of handling up to 11 x 17 paper)
c. Full offset stacking capability (with no sorter bins required)
d. Minimum of 1 GB RAM
e. Minimum of two (2) adjustable paper trays with capacity up to 500 sheets each and for various paper sizes (letter, ledger, & 11 x 17)
f. Duty cycle of at least 200,000 sheets per month
g. Recommended print volume of 15,000 sheets per month
    i. Recommended print volume of 30,000 sheets per month (desirable)
h. Finishing - automatic stapling capabilities, that can staple a minimum of 25 sheets of 20 lb. paper
i. Reduction and Enlargement in pre-set and in zoom (25% to 400%)
j. Image overwrite security features that completely delete all files after printing
k. Network Authentication that validates network user names and passwords
l. Standard network connectivity: 10/100/1000BaseTX Ethernet, IPv6

Each MFD must be capable of scanning, copying, faxing and printing as described in the following sections.

### 5.9.1.1. MFD Monochrome Scanner Functionality

The scanner functionality of the MFD must provide:

a. Resolution –600 X 600 ppi (pixels per inch)
b. Optical Character Recognition (OCR) software
c. Scan to desktop, e-mail, or to network folders to formats including but not limited to: TIFF/TIFF-F/Multi-page TIFF/PDF/ JPEG
d. Ability to scan single-sided or duplex originals without intervention.
e. Solution for encrypted point-to-point scanning (printer to desktop).
f. Scans max paper size 11 x 17 at 600 dpi with 256 grayscale increments
g. SMTP and POP before SMTP authentication
h. TWAIN scanning to provide alternative scanning options for networked users

#### 5.9.1.2. MFD Monochrome Fax Functionality

The fax functionality of the MFD must provide:

a. Fax to Fax
b. Internet faxing (desirable)
c. Group dialing
d. Quick dialing
e. Page by page job status at the machine
f. Transmission confirmation
g. Full Dual Access allows simultaneous document scanning and fax reception
h. Automatically stores incoming faxes in memory in the event paper or toner runs out

#### 5.9.1.3. MFD Monochrome Print Functionality

The print functionality of the MFD must provide:

a. Resolution minimum 1200 X 1200 dpi
b. 136 Postscript fonts
c. 80 PCL fonts
d. Secure print function, which permits the user to print using an identification code/name.
e. Printer language – Adobe PostScript® 3™, PCL® 5c emulation, PCL® 6 emulation
f. Minimum of 55 pages per minute

### 5.9.2. Medium Volume Color MFD Requirements

The medium volume MFD device must meet the following requirements:

a. Fully Automatic Duplexing (1-2, 2-2, and 2-1)
b. Auto Document Feeder (capable of handling up to 11 x 17 paper)
c. Full offset stacking capability (with no sorter bins required)
d. Minimum of 1 GB RAM
e. Minimum of two (2) adjustable paper trays with capacity up to 500 sheets each and for various paper sizes (letter, ledger, & 11 x 17)
f. Duty cycle of at least 30,000 sheets per month
g. Recommended print volume of 5,000 sheets per month
h. Finishing - automatic stapling capabilities, that can staple a minimum of 25 sheets of 20 lb. paper
i. Reduction and Enlargement in pre-set and in zoom (25% to 400%)
j. Image overwrite security features that completely delete all files after printing
k. Network Authentication that validates network user names and passwords
l. Standard network connectivity: 10/100/1000BaseTX Ethernet, IPv6

Each MFD must be capable of scanning, copying, faxing and printing as described in the following sections.

#### 5.9.2.1. MFD Color Scanner Functionality

The scanner functionality of the MFD must provide:

a. Resolution –600 X 600 ppi (pixels per inch)
b. Optical Character Recognition (OCR) software
c. Color scan speed: 50 sides per minute

d. Scan to desktop, e-mail, or to network folders to formats including but not limited to: TIFF/TIFF-F/Multi-page TIFF/PDF/ JPEG
e. Ability to scan single-sided or duplex originals without intervention.
f. Solution for encrypted point-to-point scanning (printer to desktop).
g. Scans max paper size 11 x 17 at 600 dpi with 256 grayscale increments
h. SMTP and POP before SMTP authentication
i. TWAIN scanning to provide alternative scanning options for networked users

#### 5.9.2.2. MFD Color Fax Functionality

The fax functionality of the MFD must provide:

a. Fax to Fax
b. Internet faxing (desirable)
c. Group dialing
d. Quick dialing
e. Page by page job status at the machine
f. Transmission confirmation
g. Full Dual Access allows simultaneous document scanning and fax reception
h. Automatically stores incoming faxes in memory in the event paper or toner runs out

#### 5.9.2.3. MFD Color Print Functionality

The print functionality of the MFD must provide:

a. Resolution minimum 1200 X 1200 dpi
b. 136 Postscript fonts
c. 80 PCL fonts
d. Secure print function, which permits the user to print using an identification code/name.
e. Printer language – Adobe PostScript® 3™, PCL® 5c emulation, PCL® 6 emulation
f. Minimum of 55 pages per minute (Monochrome / letter)
g. Minimum of 45 pages per minute (Color / letter)

#### 5.9.3. MFD Consumables

At a minimum, the following consumables must be provided:

a. Staples – supply for medium volume monochrome printer (minimum of 5000)
b. Toner – supply for medium volume monochrome printer (minimum replacement of toner initially supplied with system)
c. Paper:
    1. 8.5" x 11" White; 5,000 sheets per case
    2. 11" x 17" White; 2,500 sheets per case

## 5.10. Additional Support Devices Technology

Basic network equipment in support of supporting systems technology (additional technology)

Basic storage equipment in support of supporting systems technology (additional technology)

Devices running client-oriented OS's such as Windows, Macintosh, etc. to allow direct monitoring of supporting technology (additional technology)

Systems security technology (additional technology)

Image and display tools in support of supporting technology considerations and configurations (additional technology)

## 5.11. Support Devices Specialists

To assist in product recommendations, installation, and support of computer systems products the following specialists shall be supported:

a. Information Assurance Specialist

1. Analyzes general information assurance-related technical problems and provides basic engineering and technical support in solving these problems. Supports the integration of information assurance solutions and technologies into supporting IT equipment with particular attention to protocols, interfaces, and system design. Analyzes and defines security requirements for supporting IT systems. Designs, develops, engineers, and implements solutions that meet systems security requirements. Responsible for integration and implementation of the security solution. Performs vulnerability/risk analyses of computer systems and applications during all phases of the system development life cycle. Configures test beds and conducts testing, records and analyzes results, and provides recommendations for improvements for the products/systems under test. Analyzes and defines security requirement for computer systems which may include mainframes, workstations, and personal computers. Designs, develops, engineers, and implements solutions that meet security requirements. Responsible for integration and implementation of the computer system security solution. Gathers and organizes technical information about an organization's mission goals and needs, existing security products, and ongoing programs in computer security. Performs risk analyses of computer systems and applications during all phases of the system development life cycle. Applies principles, methods, and knowledge of security to specific areas task order requirements. Test developed systems at each point of entry for ease of unregulated entry; systems resources denial; system information corruption; unlawful use of system resources; vulnerability to electronic disruption.

b. Experience Requirements: This position requires a minimum of seven years of substantial experience in system security analysis and implementation; design assurance or testing for information assurance products and systems; integration or testing for information assurance products and systems. Experience in heterogeneous computer networking technology and work in protocol and/or interface standards specification is recommended.

b. Hardware Engineer

1. Provides functional and empirical analysis related to the design, development, and implementation of hardware for products including, but not limited to, the circuit design of components, development of structure specifications of a personal computer, and the design of a computer display unit. Participates in the development of test strategies, devices, and systems. Possesses and applies a comprehensive knowledge of a particular field of specialization to the completion of significant assignments. Plans and conducts assignments, generally involving the larger and more important projects or more than one project. Evaluates progress and results and recommends major changes in procedures. May lead or direct projects.
2. Experience Requirements: Ten years of intensive and progressive experience in a computer related field including development and design of complex hardware and communications systems.

# 6. Category B: Group D: Network Devices, Computer Security Tools and Advanced Video and Conference Tools

This section specifies equipment needed to support a full implementation of computer systems in the NASA network environment in terms of networking and computer security along with support of audio-visual related requirements. These items may be purchased by the Government separately from the computer systems but rely on standards and standard interfaces to ensure interoperability with the computer systems.

All proposed mandatory products must meet the following (where applicable):

a. EPEAT certified
b. Energy Star compliant
c. 508 compliant
d. Trade Act (TAA) compliant.
e. New Equipment
f. Authorized reseller for the following mandatory products:
   Wireless Access Point
   High End LAN switch chassis (OEM1)
   High End LAN switch chassis (OEM2)
   Large Network Router
   VPN Appliance

## 6.1. Network and Communication Devices

This section describes the mandatory requirements for the base network technology including network hardware, software and communication devices. While comprehensive and specific functional and performance specifications do not exist for each supporting network equipment, all equipment must meet the Network Core Specification, unless noted otherwise.

### 6.1.1. Network Technology Core Specification

All mandatory network equipment must meet or comply with the Network Core Specification in this section. That means that the requirements of this section are additive to (or a clarification of) the requirements stated for each specification of the Supporting Network Equipment.

a. Advanced networking techniques (both hardware and software) to allow connectivity unassociated with physical location; such as wireless technology and applications which allow roaming client computers to connect to networks and people, (advanced technology)
b. The capabilities of the routers, switches, and NIC's in terms of high performance interfaces and high bandwidth implementations (advanced technology).

#### 6.1.1.1. Core Network Technology

The base technologies for building Local Area Networks in NASA are Ethernet and Wireless. Throughout the sections on Network Supporting Equipment, the terms "Ethernet", "Wireless" are used to define the requirements. Unless otherwise specified, the specific meaning of these terms is given here and shall apply throughout Section 6.1.

*6.1.1.1.1. Ethernet*

Ethernet interfaces shall comply with both Ethernet Specification 2 and IEEE standards [IEEE 802.3; ISO 8802/3].

a. "Ethernet" in this document requires a 10/100/1000 UTP port base capability. Additional capability spelled out as required.

*6.1.1.1.2. 802.2 Data Link Layer*

Ethernet shall include the Data Link Layer protocol providing Logical Link Control [ISO 8802/2].

*6.1.1.1.3. Wireless*

Wireless interfaces shall comply with the following standards:

a. IEEE 802.1p (desirable)
b. IEEE 802.1x
c. Authentication: 802.1x support, including Protected EAP-Generic Token Card (PEAP-GTC), PEAP-Microsoft Challenge Authentication Protocol Version 2 (PEAP-MSCHAPv2), EAP-Transport Layer Security (EAP-TLS), EAP-Tunneled TLS (EAP-TTLS) and EAP-Subscriber Identity Module (EAP-SIM) to yield mutual authentication and dynamic, per-user, per-session encryption keys (WPA and WPA2), MAC address and standard IEEE 802.11 authentication mechanisms.
d. Encryption: AES-CCMP encryption (WPA2), TKIP encryption enhancements: key hashing (per-packet keying), message integrity check (MIC) and broadcast key rotation via Cisco TKIP or WPA TKIP, support for dynamic IEEE 802.11 WEP keys of 40 bits and 128 bits.
e. Remote configuration support: BOOTP, DHCP, HTTPS, FTP, TFTP, SNMP and ssh (desirable)
f. Support IEEE Standards a/b/g/n

*6.1.1.1.4. Multiprotocol Label Switching (MPLS)*

Multiprotocol Label Switching (MPLS) interfaces shall support the following features:

a. MPLS Architecture (RFC 3031)
b. MPLS Signaling: Label Distribution Protocol (RFC 3036) or RSVP
c. MPLS Traffic Engineering (RFC 2702)
d. MPLS Layer 2 and Layer 3 Virtual Private Networks (VPNs)

**6.1.1.2. Network Management**

All mandatory network equipment in this solicitation shall provide the management functions in this section.

*6.1.1.2.1. Simple Network Management Protocol (SNMP)*

Provide an SNMP agent [RFC 1157; RFC 1213] for remote network management and monitoring.

a. vendor specific private extensions shall conform with RFC 1155.
b. vendor specific private extensions shall be made available to the Government in ASN format.
c. remote management and control of all unit, card, and port level SNMP configurable parameters.
d. SNMP Version 2c
e. full RMON or RMON II capability (RFC 1271) (desirable)

*6.1.1.2.2. Console Management Access*

a. Out-of-band management through a console port shall be available for all networking equipment.
b. Multiple levels of management access. Preferably, this includes a minimum of three levels:
   - full read/write,
   - read only of all possible fields except passwords, and
   - limited read only.

*6.1.1.2.3. Configuration Recovery*

Non-volatile storage shall be provided on all networking equipment for the purposes of maintaining configuration and fault/diagnostic information. Non-volatile storage shall:

a. enable a network device which has lost power to recover fully on power up by restarting and accessing all configuration data required for proper operation in the network.
b. be accessible from the network and from the out-of-band management console port.

*6.1.1.2.4. Network Management Software*

Network management software, which may consist of multiple applications, for multivendor networks shall be provided with the following characteristics:

a. a consistent user interface and an integrated environment for monitoring, troubleshooting, controlling and measuring performance of network components.
b. be able to discover and display graphically the network components and their relationship.
c. allow a network administrator to make configuration changes, and run diagnostic and performance statistics gathering applications.
d. at least adhere to SNMP and provide MIB and RMON support for various networking technologies (e.g. Ethernet, WDM, etc.).
e. include analysis software which presents the performance and monitoring data in easily comprehensible graphics (viewable on a terminal or a printer).
f. include configuration management software to track changes, modifications and current configuration of network devices
g. Downline loading via the network of software upgrades to all networking equipment (desirable)

**6.1.1.3. Equipment Characteristics**

This section describes general equipment characteristics

*6.1.1.3.1. Physical Configuration*

Where appropriate, all equipment shall be mountable in a standard EIA 19" rack. All mounting hardware shall be included with the equipment.

*6.1.1.3.2. Operating Environment*

a. Where appropriate, all equipment except large network routers shall be capable of operating on line voltage of 108 to 125 volts single-phase at 60 Hz (+/-1%).
b. Large network routers shall be capable of operating on line voltage of either 108 to 125 volts or 216 to 240 volts single-phase at 60 Hz (+/-1%).

**6.1.1.4. Documentation**

*The contractor shall provide access to complete sets of commercially available system and user manuals. All provided documentation shall be available on line.*

**6.1.1.5. Auto Configuration**

In general, no management intervention or software down line loading should be required to become operational (other than the potential manual installation of an IP address). The network equipment shall auto-configure and self initialize at installation (connection and power up) and during operation. That is, it shall be possible to simply connect the network interfaces and apply power for the network equipment to become operational without detrimental impact to the network. Auto-configuration does not apply to routers or ATM switches.

**6.1.1.6. Bridging**

Bridging is required in all routers and all bridging shall provide the capability for:

a. disabling of any Spanning Tree Algorithm [ISO 8802/1; IEEE 802.1] incorporated within the bridge.
b. Protocol filtering which is based upon user defined filtering masks.
c. interface line speed filtering and 80% of interface line speed forwarding, with minimum data packet sizes applicable to the interface type

### 6.1.2. Wireless Networking Equipment

The following wireless networking equipment is required.

#### 6.1.2.1. Wireless Access Points

Wireless Access Points such as Cisco Aironet 1600 shall meet the following:

a. Capable of supporting multiple VLANs.
b. Capable of supporting Wireless encryption methods
c. Capable of utilizing external authentication service (RADIUS) in addition to supporting Wireless authentication methods
d. Support 802.11/a/n/g interfaces
e. Powered using Power-over-Ethernet (or 802.3af)
f. Remotely configurable

#### 6.1.2.2. Wireless LAN Manager

Wireless LAN Manager such as the Cisco Prime Infrastructure wired/wireless LAN management solution shall meet the following:

a. Device can monitor, configure and report the status of access points
b. Capable of performing management functions autonomously, based on network conditions or on a scheduled basis
c. Capable of centrally managing at least 250 access points per management device

#### 6.1.2.3. Wireless Bridge

Wireless Bridge such as Cisco Aironet 1552 Wireless Bridge shall meet the following:

a. Capable of bridging two wired LANs using a wireless link.
b. external antenna ports that are compliant with 802.11b/g standards (2.4 GHz)
    1. 802.11n (desirable)

### 6.1.3. LAN Switches

At least 2 solutions, each from a different OEM, for the High End LAN switch is required. Each interface port shall

a. be an independently switched port capable of supporting a LAN segment or single user connection.
b. support the Spanning Tree Algorithm [ISO 8802/1; IEEE 802.1d].
c. all Ethernet uplink ports and uplink port modules shall be capable of supporting trunking (Spanning Tree disabling and aggregate bandwidth utilization over multiple physical uplink ports).

#### 6.1.3.1. High End LAN Switches

High End LAN switch chassis such as Cisco 6509 shall provide the ability to equip any one of the following configurations:

a. 10/100/1000 UTP Autosensing Ethernet interfaces, at least 18 ports (the proposed mandatory chassis must be fully configured with the appropriate cards, powers, etc. for this configuration).
b. 1000BaseSX capability , at least 4 ports
c. 1000BaseLX capability, at least 4 ports
d. 10 Gigabit (802.3ae) uplink port (desirable)Support for MPLS Interfaces (desirable)

The following is required for installed configurations from the previous list

e. Ability for concurrent configuration of installed interfaces

### 6.1.4. Network Router

At least 2 solutions, each from a different OEM for Medium Network Router are required. One solution for the Large Network Router from any OEM meeting the mandatory requirements is required. Each size router may but do not have to have different OEMs.

Two network routers are required; a medium format router with an average number of interfaces and expansion capability and a large format router with substantial expansion capability and larger variety of interfaces. The next two subsections describe the overall features of the small, medium and large routers, while the third subsection describes specific requirements that shall apply to all routers.

#### 6.1.4.1. Medium Network Router

A Medium Network Router (single chassis) such as Juniper M10 shall provide the following configuration options; i.e. the chassis shall have the option to be configured in any one of the following ways):

a. 8 or more Ethernet interfaces.
b. 1 or more Gigabit Ethernet interfaces (configured as SX and/or LX) (desirable).
c. Serial interfaces (desirable)

#### 6.1.4.2. Large Network Router

A Large Network Router (single chassis) such as Juniper M20 shall provide the following configuration options; i.e. the chassis shall have the option to be configured in any one of the following ways):

a. 24 or more Ethernet interfaces.
b. 6 or more Gigabit Ethernet interfaces
c. Serial interfaces (desirable)
d. Gigabit Ethernet, LX or SX
e. 10 Gigabit (802.3ae) (desirable)

#### 6.1.4.3. All Network Routers

All network Routers shall provide the following specifications

##### *6.1.4.3.1. General Protocol Requirements*

Routers shall provide the following capabilities:

a. simultaneous routing and bridging, selectable by protocol and by port.
b. the Spanning Tree Protocol [ISO 8802/1; IEEE 802.1d] (desirable).
c. Point-to-Point (PPP) Protocol [RFC 1661]
    1. PPP RFC 1332 or subsequent version (desirable).
d. Frame Relay Protocols [ANSI T1.606 with LMI Extensions]

##### *6.1.4.3.2. Routing Protocols*

Routers shall provide the following routing protocols and their sub-elements:

a. TCP/IP Internet Protocol
    1. Routing Information Protocol (RIP) [RFC 1058].
    2. Routing Information Protocol 2 (RIP2) [RFC 1723]
    3. variable length subnet masking.
    4. manual configuration of the broadcast address (i.e. support for all 1's or all 0's).
    5. Border Gateway Protocol (BGP) [RFC 1771 - 1774]
    6. OSPF version 2 [RFC 2328].
    7. Intermediate System-to-Intermediate System (IS-IS) Protocol [RFC 1195]
    8. IP Multicast
        a. PIM [RFC 2362]
        b. MOSPF [RFC 1584] (desirable)

##### *6.1.4.3.3. Network Management*

In addition to the Core Network Management requirement (Section 6.1.1.2.), each Network Router shall include the following:

a. NTP version 3 or later, at least in client mode [RFC 1305]

b. Response to ICMP echo request (ping) [RFC 792]
c. Secure Shell (SSH) in server mode for both logins and file transfers
d. SSH in client mode to support logins
e. Support RADIUS [RFC 2865] or TACACS+ for authentication
f. Support SYSLOG [RFC 3164] for remote logging
g. Capability to disable unused or unneeded services
h. Capability to restrict access for enabled services
i. ISIS MIB[RFC 1195]
j. Connectionless Network Protocol MIB [RFC 1238] (desirable)
k. OSPF MIB [RFC 1850] (desirable)
l. MIB extensions for DS1 [RFC 1406; RFC 1239] and DS3 [RFC 2496; RFC 1239] (desirable)

*6.1.4.3.4. Ethernet Connectivity*

In addition to the Ethernet requirement (Section 6.1.1.1.1.), all network router shall support connectivity with the following:

a. 10/100/1000 BaseT Autosensing
b. 100BaseFX (desirable)
c. Gigabit Ethernet (desirable)

### 6.1.5. Radio Equipment

Radio equipment shall be provided which at a minimum:

a. 2-way radio with display;
b. Battery offering 14 hrs of Operation; <= 2.5 hours to full charge;
c. 6 channels minimum;
d. Time Out timer;
e. Scan function;
f. Tone Alert; Low Battery Alert; Key Lock and Battery Save;
g. VOX Ready;
h. STD 810 C,D,E & F MIL Standards

### 6.1.6. Internet Protocol (IP) Telephony System

IP Telephony System capable of meeting the following:

a. Signaling protocols
   1. ITU H.323v2 protocol suite
   2. IETF SIP and MGCP
b. Security: Secure RTP (SRTP)
c. QoS: Traffic classifications (tagging the packets) – both Layer 2 and Layer 3
d. Transport: RTP/UDP
e. Scalable to support at least 25,000 simultaneous users
f. H.323 Gateway
g. SIP, Session Initiation Protocol
h. G.711 Codec
i. Support for a 5 Digit Dial Plan
j. Features
   - Voice Mail
   - Meet Me
   - Call Detail Record (CDR)
   - Analog Devices
   - Call Groups
   - Call Transfer

- Call Forwarding
- Hold
- Caller ID
- Call Waiting
- Park
- Call Pick Up
- Able to program features of IP Phones and IP Softphones from a central location
- Programmable keys

**6.1.6.1. VOIP SoftPhones / Software**

1. SoftPhones and related Unified Communication technology (advanced technology)

**6.1.7. Cell Phone**

A cell phone including annual service shall be provided with a minimum:

a. 2GB / month data plan
b. Unlimited talk / talk
c. 50 state coverage
d. Phone
    1. Minimum 4 inch screen
    2. Minimum 8 megapixel camera
    3. GPS navigation
    4. Touch screen keypad
    5. Minimum screen resolution: 1130x640
    6. Ambient light sensor
    7. Wireless Connectivity: 3G; 4G; Bluetooth; Wi-Fi
    8. Minimum of 16 GB storage
e. One year service plan;

**6.1.8. Network Diagnostic Tools**

The following network diagnostic tools are required.

a. Portable Hardware based network protocol analyzer:
    1. Six layer protocol analysis
    2. Active discovery
    3. SNMP device analysis
    4. RMON2 traffic analysis
    5. optional WAN and wireless monitoring
b. The following tools are desirable:
    1. Network sniffer tool
    2. Circuit test equipment

**6.1.9. Network Optimization Support for Core Routing & Switching**

This section provides requirements for a product based engineering service to be supported. While this requirement uses generic term of "Network Product", the proposed services shall be tied to a specific brand name product; e.g. Cisco, Juniper, etc.

a. The primary purpose of this "Network Product" service is to provide technical assistance to aid with routing and switching products and technology. The skill set or capabilities of the personnel providing assistance under this service include:
    1. "Network Product" Certified Expert;
    2. In-depth knowledge and experience designing and configuring complex routing and switching networks;
    3. Working knowledge of advanced technologies such as security, voice, and content/data center fields;

4. Ability to conduct training and one to one mentoring concerning routing and switching technology.

b. Network Optimization Support for Core Routing & Switching shall include but is not limited to the following:
   1. Combination of On-Site and Remote Support
      a. Onsite support available 4 days a week
   2. Operations Management
      a. Analysis of critical issues / trends
      b. Quarterly reviews
   3. Network Improvement Plan Support
      a. Scheduled change network analysis
      b. Review of implementation plans
      c. Assistance with scheduled and unscheduled network hardware, software and configuration issues as necessary
   4. Software Strategy and Reporting
      a. Software recommendations
      b. Critical bug analysis
      c. Quarterly reports
   5. Performance Engineering and Optimization
      a. Network health checks
      b. "Best practices" comparisons/recommendations
   6. Annual Operational Assessment

### 6.1.10. Advanced Network Technology

Some advanced networking technologies include Satellite Network Communications, Fiber Optic Broadband and Telemetry (remote sensors). Satellite Network Communications provides support for utilization of satellite links for supporting both LANs and WANs. Fiber Optic Broadband provides for fiber optic broadband service as part of a remote access solution. Telemetry supports the transmission of data captured by instrumentation and measuring devices to a remote station, for recording and analysis.

## 6.2. Computer Security Tools

This section specifies software and equipment needed to support a full implementation of computer systems and infrastructure in the NASA network environment. These items may be purchased by the Government separately from computer systems but rely on standards and standard interfaces to ensure interoperability with the computer systems and the supporting networks.

### 6.2.1. Security Tools Core Specification

All mandatory security tools must meet the following specifications:

a. Compliance with NIST Federal Information Processing Standards (FIPS) requirements including FIPS 140-2 and FIPS 201, where applicable
b. User extensible features in each software package, such as the ability for a user to add intrusion detection signatures, file signatures and similar features to network monitors (advanced technology)
c. Information technology products which have been evaluated and certified/validated in accordance with the provisions of the NIAP Common Criteria Evaluation and Validation Scheme and the Common Criteria Mutual Recognition Arrangement (CCMRA) and conform to the Common Criteria for IT Security Evaluation (ISO Standard 15408) (advanced technology).

### 6.2.2. Anti-spam Appliance

At least 2 solutions, each from a different OEM, for the following anti-spam appliance is required. Anti-spam appliance, such as Barracuda Spam Firewall, shall be provided which at a minimum:

a. Self-contained hardware appliance
b. Support at least 10,000 active e-mail users

c. Capacity of 10 million e-mails / day
d. Handle up to 5,000 domains
e. 72 GB of quarantine storage
f. Compatible with Microsoft Exchange, Lotus and Eudora e-mail servers
g. Gigabit Ethernet connectivity
h. Web-based interface
i. Variety of protections supported:
   - Spam filter
   - Virus Filter
   - Anti-spoofing
   - Anti-phishing
   - Anti-spyware
   - Denial of Service
   - Outbound e-mail filtering
j. Spam filter functionality including:
   - Content-based
   - Intent analysis
   - Keyword Blocking
   - Multi-national
   - Rate control
   - Rule-based scoring
   - SPF and Sender-ID
k. E-mail tagging, quarantine and blocking
l. Whitelists and blacklists (both global and user configurable)

### 6.2.3. Anti-spyware Software

Anti-spyware software which detects and removes Spyware from systems running Windows shall be provided with the following minimum specifications:

a. Protection against DLL injection
b. Protection against 3rd party uninstall
c. Automated definitions file update
d. Automated operation
e. Automated scanning
f. Quarantine support
g. Real-time monitor
h. Registry protection
i. Executable file extension protection
j. Printable reports
k. Centrally managed Enterprise-based version
   1. 25 client seats
   2. Help desk support

### 6.2.4. Server Level Intrusion Protection and Detection Software

Server level intrusion protection and detection software for Windows servers such as ISS's RealSecure Server, shall be provided with the following minimum specifications:

a. Automatically detect and block malicious activities
   1. monitor all inbound and outbound traffic
b. Multi-level protection
c. Automatic, instantaneous user alerts of threats
d. Intruder data collection including IP address and
   1. data collection including hardware address in at least 1 solution (desirable)
e. System logging of all illicit activity

f. Automatic notification of updates
g. 25 server license

### 6.2.5. Vulnerability Assessment Software

Vulnerability assessment software, such as ISS Internet Scanner, that scans networked devices for vulnerabilities shall be provided which at a minimum:

a. scan an entire domain, subnetwork or system to detect security vulnerabilities including:
   - brute force password guessing
   - backdoors
   - cgi-bin
   - daemons
   - firewalls
   - network sniffers
   - protocol spoofing
   - web scan
   - Windows patches and policy issues
b. capable of scanning a local host or multiple hosts on a given network
c. capable of identifying and scanning networked devices including:
   1. MAC OS, Windows, LINUX and UNIX desktop and server
   2. network routers and switches
   3. security appliances
   4. application routers
d. capable of identifying and scanning networked devices including:
   1. desktops
   2. servers
e. default and custom scanning policies
   1. searchable policy system
f. Administration access and control
   1. domain account registration
   2. database administration
   3. local logging
   4. support for administrative access to end points
g. Real-time display options to quickly identify vulnerabilities and vulnerable hosts
h. Comprehensive information on root cause and remediation steps
i. 2500 seats

### 6.2.6. Virtual Private Networking Appliance

Remote access Secure Sockets Layer (SSL) Virtual private network (VPN) appliance shall be provided which at a minimum:

a. provide a secure end-to-end private data network over a public network infrastructure
b. license for at least 1,000 concurrent HTTP clients and 100 non-HTTP clients
c. support connections using Internet Explorer and Apple's Safari and Mozilla Firefox browsers
d. support for web applications including:
   - ActiveX
   - Java applets
   - JavaScript
   - Flash
   - HTML
   - JavaScript
   - VBScript
   - Web e-mail via Lotus Notes and Outlook Web Access
e. Terminal Services including:

- Citrix Metaframe
- Microsoft Terminal Server
- X11

f. Client support non-HTTP applications including:
   - ActiveX
   - Java applet

g. SSL tunneling
   a. support TCP/UDP

h. support SMB/CIFS file sharing;

i. support the following authentication methods: local user ID/password, LDAP, Active Directory, ActivCard ActivPack, RADIUS, Windows NT Domain and RSA SecurID, X.509 digital certificates

j. granular access control and authorization:
   a. user- and group-based memberships,
   b. role-based access,
   c. LDAP/AD attributes,

k. Three 10/100/1000 Base-T Ethernet ports

l. support for Apple, Linux and Microsoft Windows client OS

m. FIPS 140-2 compliance

n. Central administration, monitoring and reporting

o. Load balancing options

### 6.2.8. Biometric Scanning Devices

Biometric scanning devices to provide fingerprint-based secure access to computer systems shall be provided which at a minimum:

a. Compliant with SP 800-73 (data APIs) and SP 800-76 (biometric data specification) (desirable)
b. USB connectivity
c. portable
d. integrated finger guide
e. optical or capacitive sensor
f. latent print image removal
g. encryption of fingerprint templates
h. 500 dpi resolution
i. Verification time of less than 1 sec
j. Software to allow fingerprint based logon and file encryption
k. Windows support
   1. Linux support (desirable)
   2. Apple Mac OS X support (desirable)
l. Fingerprint-based scanner for access to facilities, computer rooms, etc (desirable)
m. Retina and iris scanning devices and other forms of biometric scanning devices (advanced technology)

### 6.2.9. Smart Card Readers

Smart card reader devices to provide smart card secure access to computer systems shall be provided which at a minimum:

a. Compliant with SP 800-73 (data APIs) and SP 800-78 (card specification) (desirable)
b. USB connectivity
c. portable
d. T=0, T=1 Protocol support
e. 344,000 bps speed
f. Support ISO 7816 Class A and AB smart card
g. Windows, MAC OS, and Linux OS support
h. Readers for access to facilities, computer rooms, etc (desirable)

## 6.3. Advanced Video and Conference Tools

This section describes the requirements for a set of mandatory products related to audio-visual technology.

### 6.3.1. Video Acquisition Devices

The following video acquisition devices shall be provided:

a. HDTV Studio Camera Systems such as the Grass Valley LDK 8000 Elite including:
   1. Three 2/3-inch type 16:9 FT or FIT CMOS or CCD imagers each with 921600 or greater pixels that conform to 1280 (H) x 720 (V) CIF (Common Image Format)
   2. 34-bit digital signal processing resolution
   3. Minimum of 14-bit A/D sampling.
   4. SMPTE-292M output available.
   5. Signal-to-noise ratio of 54dB
   6. Horizontal resolution ≥ 700 TV Lines Per Picture Height
   7. 6" or greater HDTV viewfinder.

b. Professional Digital Single Lens Reflex (SLR) Camera such as the Canon Eos 7D with the following minimum specifications:
   1. High-sensitivity, High-resolution, Single-plate CMOS Sensor
   2. 17.9 megapixels
   3. 3:2 (Horizontal:Vertical) Aspect Ratio
   4. support for the following optional file types / sizes
      - Large: 17.9 Megapixels
      - Medium: 8.0 Megapixels
      - Small: 4.5 Megapixels
      - RAW: 10.1 Megapixels
   5. Combination of preset and user-defined picture style function with individual adjustments for sharpness, contrast, saturation and color tone
   6. Video mode with sound - MOV format; 1920X1080 file size in full HD mode
   7. USB 2.0 interface
   8. Focusing modes of: Autofocus, (One-Shot AF, Predictive AI Servo AF, AI Focus AF (automatic switching between One-Shot/Predictive AI Servo AF)) and Manual Focus (MF)
   9. Exposure Control Systems: Program AE (Shiftable), Shutter speed-priority AE, Aperture-priority AE, Full Auto, E-TTL II autoflash program AE, Manual exposure
   10. ISO Speed ranges: Equivalent to ISO 100-6400 (in 1/3-stop increments)
   11. Shutter Speeds of 1/8000 to 30 sec. (1/3-stop increments)
   12. Self timer shutter release with option of 2 sec. or 10 sec timing delay
   13. Focusing options: Quick mode, Face detection, Manual
   14. Built in autoflash
   15. Camera bag
   16. Lens

c. Conference room double bay multimedia lectern with semi-recessed (up to 18 inch) LCD flat panel display
   1. height adjustable monitor support
   2. storage area with locking doors
   3. remote-switched, surge-protected 6-outlet power strip
   4. Pullout platform for keyboard / mouse
   5. Approximate size of 54X26X42 inches (Width x Depth x Height)

d. Studio lighting including 750 watts of high impact strobe output

f. High-output dynamic vocal microphone:
   1. frequency response: 50 to 15,000 Hz
   2. Rated low impedance of 50-1,000 ohms
   3. Dynamic range: 140 dB
   4. adjustable slip stand adaptor
   5. supercardioid or hypercardoid

### 6.3.2. Audio Video Monitor and Display Devices

The following Audio Video Monitor and Display Devices must be provided:

a. Stereo speakers
   1. 2 speakers including tweeter nad woofer
   2. Impedance : at least 6 ohms nominal
   3. Sensitivity: in the range of 85-90 db at 1 meter with 2.83 Volt input
   4. Frequency response: at least a range of 50 Hz - 20 kHz

b. Wall mountable 46" Wide LED TV
   1. 46 inch diagonal screen size
   2. Native resolution at least 1920X1080p
   3. 5 modes for Aspect Ratio: 16:9/Just Scan/Set by Program/4:3/ Cinema Zoom 1
   4. Wall mount hardware

c. 42 inch digital signage monitor
   1. 1080p 9ms panel
   2. 16.3mm slim bezel
   3. 7 day on/off scheduling
   4. Built-in 5Wx2 speaker with 7Wx2 output
   5. Remote and panel control lockout
   6. RS-232 daisy-chain capable
   7. Screen saver/image sticking protection
   8. VGA and DVI inputs/outputs for connectivity and control
   9. Stand-alone license for a signage software package that delivers program creation, registration, scheduling and distribution of pre-scheduled information

d. Document Kiosk
   1. 19" LCD Monitor
   2. Full Metal sealed keyboard
   3. Mono-Chrome Laser Printer capable of printing pay stubs and reports with Paper Tray.
   4. Computer: minimum of 1.6 GHz Dual Core Processor; 2 GB RAM; 64.0 Gig SS HD
   5. Surge protection for all electronics
   6. Kiosk Software/interface:
      a. OneFinger - Touch Screen Keyboard
      b. Kerberos - Basic Lock Down Software
      c. Team Viewer - for Remote Access
   7. Heavy duty Metal Enclosure
   8. 2 External USB Ports
   9. Internal cooling system

### 6.3.3 Virtual Environment Devices

The following Virtual Environment Devices must be provided:

a. Tactile glove haptic device such as the CyberGlove Systems CyberGlove II with minimum specifications of:
   1. Number of sensors: 5
   2. Sensor Resolution: < 1 degree
   3. Sensor Repeatability: 3 degrees
   4. Sensor Linearity: 0.6% maximum nonlinearity over full joint range
   5. Sensor Data Rate: 90 records/sec (typical)
   6. Wireless Technology: 2.4 GHz
   7. Operating Range: 30 ft radius from USB port

## 6.4. Racks / Enclosures / Carts

The following Racks and related products must be provided:

a. Medical Exam Station
   1. Lightweight and Transportable Medical Exam Station
   2. Wireless Tablet Computer Enterprise Router with Mobile3G, Ethernet Port and VPN
   3. IP Stethoscope
   4. USB Video Otoscope w/5 Specula
   5. Rolling Travel Case with Extendable Handles
   6. HD video examination camera

b. Medical grade computer carts:
   1. Antimicrobial Contact Surfaces
   2. Smart Control Panel
   3. Work Light with Auto Shut-off
   4. Negative-tilt Keyboard System
   5. Mousing Surface: Left/Right Mouse Tray
   6. Ergonomic Grip Front Handle
   7. Ergonomic Grip Height Adjustment Lever
   8. 3 port USB Hub
   9. Internal Cable Management
   10. Ethernet Ready
   11. 4 durable precision casters (2 locking)
   12. Hospital Grade Spiral Power Cord
   13. Keyed Lock Security
   14. Software
       a. Battery Alert
       b. Remote PC Reboot Button
   15. LCD Height Adjustment: simple landscape to portrait adjustment
   16. Integrated Power Conditioning System

c. Cable trays and related items:
   1. Cable Tray straight sections
       a. grid pattern of 2 inches x 2 inches
       b. width/length/height = 4 inches X 2 feet X 2inches
   2. Hardware for installation
       a. Ratchet
       b. Cable Tray Cutter

d. Computer Rack Enclosure:
   1. Enclosure frame with two pair of coated, universal M6 mounting rails and package of M6 hardware
   2. Solid Top Panel fans
   3. Front Door with locking handle
   4. Rear Contour Mesh Door with locking handle
   5. Pair of solid side panels
   6. Minimum size of 84"H x 24"W x 48"D

## 6.5. Additional Technology

Devices running client-oriented OSs to allow running of security, network, image and display related tools (additional technology)

Basic storage equipment in support of security, network, image and display related tools (additional technology)

Supporting technology such as printers, scanners, etc. in support of security, network, image and display related tools (additional technology)

Security certification and accreditation services (additional technology)

## 6.6. Specialists

To assist in product recommendations, installation, and support of computer systems products the following specialists shall be supported:

a. Information Assurance Network Specialist
   1. Analyzes general information assurance-related technical problems and provides basic engineering and technical support in solving these problems. Supports the integration of information assurance solutions and technologies into networks with particular attention to protocols, interfaces, and system design. Analyzes and defines security requirements for local and wide area networks. Designs, develops, engineers, and implements solutions that meet network security requirements. Responsible for integration and implementation of the network security solution. Performs vulnerability/risk analyses of computer systems and applications during all phases of the system development life cycle. Configures test beds and conducts testing, records and analyzes results, and provides recommendations for improvements for the products/systems under test. Analyzes and defines security requirement for computer systems which may include mainframes, workstations, and personal computers. Designs, develops, engineers, and implements solutions that meet security requirements. Responsible for integration and implementation of the computer system security solution. Gathers and organizes technical information about an organization's mission goals and needs, existing security products, and ongoing programs in computer security. Performs risk analyses of computer systems and applications during all phases of the system development life cycle. Applies principles, methods, and knowledge of security to specific areas task order requirements. Test developed systems at each point of entry for ease of unregulated entry; systems resources denial; system information corruption; unlawful use of system resources; vulnerability to electronic disruption.
   2. Experience Requirements: This position requires a minimum of seven years of substantial experience in system security analysis and implementation; design assurance or testing for information assurance products and systems; integration or testing for information assurance products and systems. Experience in heterogeneous computer networking technology and work in protocol and/or interface standards specification is recommended.

b. Network Engineer
   1. Tests and analyzes all elements of the network facilities including power, software, communications devices, lines, modems and terminals and for the overall integration of the enterprise network. Responsible for the planning, design, installation, maintenance, management and coordination of the network. Monitors and controls the performance and status of the network resources. Utilizes software and hardware tools, identifies and diagnoses complex problems and factors affecting network performance. Maintains technical currency and studies vendor products to determine those which best meet client needs. Provides guidance and direction for less experienced network support technicians
   2. Experience Requirements: Seven years of increasingly complex and progressive experience in computer system/network engineering. Includes two years of specialized experience related to the task.

## 7. References

ANSI INCITS 362-2002 SCSI Parallel Interface-4 (SPI-4)
ANSI X3.64-1979/R1990 Keyboard encoding standard
ANSI T1.606 Frame Relay Protocols with LMI Extensions
ANSI T1.601-1992 ISDN U Interface
ANSI T1.605.1992 ISDN ST Interface
ANSI X3.253:1998 SCSI-3 Parallel Interface (SPI)

EIA RS-232-C Interface between Data Terminal Equipment and Data Communication Equipment

IEEE 754 Floating Point Format (32 and 64 bit)
IEEE 754-1985(R1990) IEEE Standard for Binary Floating-Point Arithmetic
IEEE 802.11 Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY)
IEEE 802.11b Higher speed Physical Layer (PHY) extension in the 2.4 GHz band
IEEE 802.1c LAN/MAN Management (15802-2-1995)
IEEE 802.11p Wireless Access for the Vehicular Environment (WAVE)
IEEE 802.1x Port Based Network Access Control
IEEE 802.3 Ethernet Specification
IEEE 1394 and IEEE 1394a Firewire interface
IEEE 1284 Standard Signaling Method for Bi-directional Parallel Peripheral Interface for Personal Computers
IEEE 1003.1-1990 Portable Operating System Interface Exchange (POSIX) Full Use Interface Definition

ISO/IEC 14882:1998 C++ compiler
ISO/IEC 1539-1:1997 Fortran 95 compiler
ISO 7816 Contact smart card
ISO 8802/1 LAN/MAN Management
ISO 8802/2 Logical Link Control Type 1 (LLC1)
ISO 8802/3 Ethernet Specification
ISO 15408 Common Criteria for IT Security Evaluation

RFC 768 User Datagram Protocol (UDP)
RFC 791 Internet Protocol (IP)
RFC 792 Internet Control Message Protocol
RFC 793 Transmission Control Protocol (TCP)
RFC 821 Simple Mail Transport Protocol (SMTP)
RFC 826 Address Resolution Protocol (ARP)
RFC 854 TELNET Virtual Terminal Protocol
RFC 904 Exterior Gateway Protocol (EGP) (Historic)
RFC 950 Internet Control Message Protocol (ICMP)
RFC 959 File Transfer Protocol (FTP) (Updated by RFC2228, RFC2640)
RFC 1058 Routing Information Protocol (RIP)
RFC 1075 Distance Vector Multicast Routing Protocol
RFC 1112 IP multicasting (Updated by RFC2236)
RFC 1155 Structure and identification of Management Information for TCP/IP-based internets (MIB)
RFC 1157 Simple Network Management Protocol (SNMP)
RFC 1195 Integrated IS-IS: Use of OSI IS-IS for routing in TCP/IP and dual environments
RFC 1213 Management Information Base for network management of TCP-IP-based Internets: MIB II
RFC 1238 Connectionless Network Protocol MIB
RFC 1239 Reassignment of experimental MIB's to standard MIB's
RFC 1271 Remote Network Monitoring Management Information Base
RFC 1305 Network Time Protocol (Version 3) Specification, Implementation
RFC 1323 TCP extensions for high performance \
RFC 1332 Point-to-Point Protocol (PPP) Initial Configuration Options
RFC 1406 Definitions of Managed Objects for the DS1 and E1 Interface Types
RFC 1584 Multicast Extensions to OSPF
RFC 1661/1662 PPP

RFC 1663 PPP Reliable Transmission
RFC 1723 RIP Version 2 - Carrying Additional Information
RFC 1742 AppleTalk Management Information Base II
RFC 1771-1774 Border Gateway Protocol (BGP)
RFC 1813 Network File System (NFS) Version 3
RFC 1850 OSPF Version 2 Management Information Base
RFC 2046 Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types
RFC 2328 OSPF version 2
RFC 2362 Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification
RFC 2496 Definitions of Managed Object for the DS3/E3 Interface Type
RFC 2702 Requirements for Traffic Engineering Over MPLS
RFC 2865 Remote Authentication Dial In User Service (RADIUS)
RFC 3164 The BSD Syslog Protocol
RFC 3031 Multiprotocol Label Switching Architecture
RFC 3036 LDP Specification
RFC 3569 Source-Specific Multicast (SSM)
RFC 3530 Network File System (NFS) version 4 Protocol